CONVENTION NUMBER

the Journal of the association for physical and mental rehabilitation

CORRECTIVE THERAPY

MAY—JUNE, 1956 VOL. 10, NO. 3

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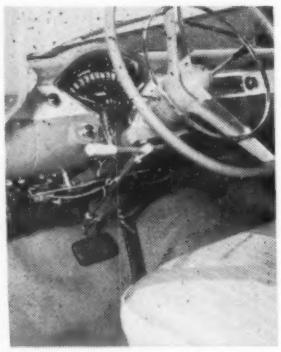

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MAY — JUNE, 1956

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THE JOURNAL OF THE ASSOCIATION FOR PHYSICAL AND MENTAL REHABILITATION

Information For Contributors

MANUSCRIPT: Manuscripts should not exceed ten (10) typewritten pages; approximately 5,000 words. Manuscripts must be the original copy, not a carbon, typed double-spaced with margins of one (1) inch for large type and one and a half (1½) inches for the small.

STYLE: Prepare manuscripts in conformity with the general style of the Journal. Retain a copy of the manuscript and duplicates of all tables, figures, charts for future use should originals be lost in the mails.

ILLUSTRATIONS: Drawings and charts should be made with India ink for photographic reproduction as zinc etchings. Photographs must be 8 x 10 inches, high contrast, black and white, glossy prints. Printed captions and related information referring to photographs, must be typed and attached to the bottom of the photograph. All illustrations should not exceed 8 x 10 inches and are more acceptable when a smaller size does not sacrifice important detail. Redrawing and preparing illustrations, to make them suitable for photographic reproduction, will be charged to the contributor.

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The City of Augusta, the State of Georgia and the Southeastern Chapter extend a very hearty welcome to the members of the Association for Physical and Mental Rehabiliattion, and their families, friends and guests. The city and hotel officials have cooperated to the utmost with the conference committee to make our Tenth Anniversary conference, a success, both professionally and socially.

Exemplifying the true meaning of southern hospitality, the management of the beautiful Bon Air Hotel has but one thought in mind—making your stay pleasant, enjoyable and homelike. The Olympic Pool is at your disposal every day and evening at no charge. Guest rooms are comfortable and the renowned Swamp Room is available for relaxation and fellowship.

Your Tenth Anniversary Convention Program has been planned for you, the members of the Association for Physical and Mental Rehabilitation, to keep you abreast of the ever changing concepts in the field of Physical Medicine and Rehabilitation with the emphasis on our specialty of Corrective Therapy. You will find the entire program instructive and interesting.

Administrative meetings will be held June 23 with the clinical sessions starting Monday afternoon, June 25, and concluding at noon, Friday, June 29. The daily sessions have been planned to provide some leisure time for the delegates.

Again we will feature the presentation of a series of papers by members of the association. Scheduled for Friday morning, these papers will cover many phases of the corrective therapy program from the practical level of the therapist in the field.

Many prominent manufacturers and distributors of physical medicine and rehabilitation equipment, supplies and tranquillizing drugs will exhibit their products. Time has been provided to enable you to observe these demonstrations and become asquainted with the companies' representatives. Available to show you the latest developments in rehabilitation devices and aids, these exhibitors provide an important conference function.

Many scientific exhibits will be presented by allied organizations to further demonstrate the complete rehabilitation program and the unanimity of purpose of the various agencies.

We urge you to have your family accompany you to this conference. There is no charge for children at the hotel, and we are certain the wives will enjoy the hospitality and activities planned for them.

The conference theme, "Rehabilitation—Yesterday—Today—Tomorrow," will be evident throughout the conference. We believe, after ten years, it is time to reevaluate our program. What have we done? What are we doing? What should we do? We are certain many of these questions will be answered during this conference and therefore makeus better equipped to understand the problems facing the patient, his family and the public.

The officers and committeemen feel they have planned a conference which will be of great value to you and to the association. The only ingredient needed to insure the success of the conference is your attendance. Plan now to join us in Augusta from June 25 through June 29.

PHIL DAVIS
CONFERENCE CHAIRMAN

General Information

Registration: Registration will begin at 9:00 A.M., Monday, June 25, 1956. The registration desk will be located in the lobby of the Bon Air Hotel. The Conference registration fee is $5.00. Registration fee for single days is $1.00 and includes both morning and afternoon sessions. Students will be registered with no charge upon presentation of their student identification card.

Badges: All members, guests and visitors will be required to wear the appropriate official conference badge for admission to the Conference Assembly room. Those attending single sessions will be provided with an appropriate badge at the time of registration. All speakers and guests are requested to register, at which time they will be issued an official badge admitting them to all sessions.

Hotel Reservations: Ample hotel reservations shou'd be available at the headquarters hotel. Those attending the conference will find that the Bon Air will offer the best in accommodations and rates. Anyone without hotel reservations should inquire at the registration desk.

Honor Awards Night: All members and guests attending the conference are invited to attend the Honor Awards Night, Thursday evening, June 28, 1956, at 8:00 P.M. Dr. Horace B. Cupp, Area Medical Director, will act as Master of Ceremonies.

Commercial Exhibits: Commercial exhibits will be located in the Plantation Room. All those attending the conference are urged to visit these exhibits. A wide variety of rehabilitaton equipment will be displayed and should be of considerable interest to those attending.

Scientific Exhibits: The scientific exhibits will be located in the Magnolia Room. There has been an excellent response reported by the Scientific Exhibit Committee, and all attending should find these exhibits both interesting and informative.

Entertainment: The Social Committee will have information for members, guests and their families that will assist you in selecting activities and in sightseeing.

BUSINESS MEETINGS — BON AIR HOTEL, AUGUSTA

Saturday, June 23

9:00 - 12:00 Noon. MEETING OF THE BOARD OF GOVERNORS.
1:00 - 5:00 P. M. MEETING OF THE BOARD OF GOVERNORS.

Sunday, June 24

9:00 - 12:00 Noon. MEETING OF THE BOARD OF GOVERNORS.
1:00 - 5:00 P. M. MEETING OF THE BOARD OF GOVERNORS (Cont'd).

Monday, June 25

9:00 - 12:00 Noon. MEETING OF THE BOARD OF GOVERNORS.

Tuesday, June 26

7:30 - 10:00 P. M. MEETING OF GENERAL ASSEMBLY (Annual Election of Officers).

Tentative Program

Tenth Annual Conference

Association for Physical and Mental Rehabilitation

June 25 - 29, 1956

The Bon Air, Augusta, Ga.

CONFERENCE THEME: "Rehabilitation—Yesterday, Today and Tomorrow."

MONDAY—June 25

9:00 - 5:00 — Registration.

9:00 - 12 — Meeting of Board of Governors.

AFTERNOON CHAIRMAN: Chris Kopf, Past President, APMR, Lyons, N. J.

1:00 - 1:30 — Exhibits.

1:30 - 2:30 — RESEARCH STUDY ON RESISTIVE EXERCISES — Frank D. Sills, Associate Professor, Physical Education, State University of Iowa.

2:30 - 4:00 — Panel: LOW BACK SYNDROME.
CHAIRMAN: A. Jerome Sparks, M.D., Assistant Director, Professional Services, V.A. Hospital, Augusta, Ga.
A CONSERVATIVE TREATMENT PROGRAM — S. S. Zintek, M.D., Chief, PMRS, V.A. Hospital, Augusta, Ga.
ORTHOPEDICS IN LOW BACK SYNDROMES — Floyd Blevin, M.D., Associate Professor of Surgery, Head of Orthopedics, Medical College of Georgia.
SURGERY IN LOW BACK SYNDROME CASES — C. Martin Rhode, M.D., Chief Surgeon, V.A. Hospital, Augusta, Ga.

TUESDAY — June 26

MORNING CHAIRMAN: Sam Boruchov, Past President, APMR, Northport, N.Y.

9:00 - 9:30 — Exhibits.

9:30 - 11:30 — Panel: CORRECTIVE THERAPY AND THE INCIDENCE OF RESTRAINT.
CHAIRMAN: S. S. Zintek, M.D., Chief, PMRS, V.A. Hospital, Augusta, Ga.
THE INCIDENCE OF RESTRAINT ON THE WARD—C. E. Jump, M.D., Chief, Acute Intensive Treatment Service, V.A. Hospital, Augusta, Ga.
THERAPEUTIC AQUATICS AND ITS EFFECT ON REDUCING RESTRAINT—Charles E. Castle, Corrective Therapist, V.A. Hospital, Chillicothe, Ohio.
GYM ACTIVITIES AND THEIR EFFECT ON REDUCING RESTRAINT—Paul E. Beck, Chief, Corrective Therapy, V.A. Hospital, Augusta, Ga.

11:30 - 12:00 — Exhibits.

AFTERNOON CHAIRMAN: Phil Davis, Executive Assistant, PMRS, V.A. Hospital, Augusta, Ga.

1:00 - 1:30 — Exhibits.

1:45 - 3:30 — OPENING OF CONVENTION
INVOCATION — Rabbi Norman M. Goldberg.

WELCOME — Hugh Hamilton, Mayor, City of Augusta.
Joseph L. Mulherin, M.D., President, Southern Medical Society.

L. R. Tighe, M.D., Manager, V.A. Hospital, Augusta, Ga.
RESPONSE—Frank S. Deyoe, President, Association for Physical and Mental Rehabilitation.

KEYNOTE ADDRESS—Harriet E. Gillette, M.D., Atlanta, Ga.

3:30 - 4:30 — TRENDS IN THE TREATMENT OF NEUROPSYCHIATRIC PATIENTS WITH TRANQUILLIZING DRUGS—Henry A. Brandt, M.D., Chief, Psychiatric Service, V.A. Hospital, Augusta, Ga.

WEDNESDAY — June 27

MORNING CHAIRMAN: Leo Berner, Past President, APMR, Bronx, N. Y.

9:00 - 9:30 — Exhibits.

9:30 - 10:30 — MENTAL HEALTH AND ITS RAMIFICATIONS — John M. Caldwell, M.D., Chief of Psychiatry, Medical College of Georgia.

10:30 - 12:00 — Symposium: MULTIDISCIPLINARY CONFERENCES AND TOTAL REHABILITATION OF THE PATIENT.
CHAIRMAN: Maurice Dunn, M.D., Director, Professional Services, V.A. Hospital, Augusta, Ga.
THE TEAM:
DOCTOR—C. E. Wiley, M.D., V.A. Hospital, Augusta, Ga.
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VOCATIONAL REHABILITATION—A. Polk Jarrell, Director, Division of Vocational Rehabilitation, State of Georgia.

12:00 - 1:00 — Exhibits.

AFTERNOON CHAIRMAN—Harold M. Robinson, Past President, APMR, Buffalo, N. Y.

1:00 - 1:30 — Exhibits.

1:30 - 2:15 — THE CONTRIBUTION OF RESEARCH IN REHABILITATION TO THE NEW CLINICAL CONCEPT OF CARDIOVASCULAR PHYSIOLOGY—Ernst Jokl, M.D., Director, Kentucky Rehabilitation Center, Inc., University of Kentucky.

2:15 - 3:00 — PROGRAM ADMINISTRATION IN CORRECTIVE THERAPY — Joseph H. Van Schoick, Special Assistant, PMRS, Veterans Administration, Washington, D.C.

3:00 - 4:00 — To be announced.

4:00 - 4:30 — A DEMONSTRATION OF THREE TECHNIQUES FOR POST-LARYNGECTOMY SPEECH — Neil W. Coppinger, Ph. D., Chief, Psychology Training Unit, V.A. Hospital, Augusta, Ga.

THURSDAY — June 28.

MORNING CHAIRMAN: Thomas J. Fleming, Past President, APMR, Montrose, N.Y.

9:00 - 9:30 — Exhibits.

9:30 - 11:30 — Symposium: THE VARIED POTENTIAL OF CORRECTIVE THERAPY.
CHAIRMAN: Louis B. Newman, M.D., Chief, PMRS, V.A. Research Hospital, Chicago, Ill.
CORRECTIVE THERAPY IN THE TREATMENT OF NEUROLOGICAL CASES—Henry Brandt, M.D., Chief, Psychiatric Service, V.A. Hospital, Augusta, Ga.
CORRECTIVE THERAPY IN THE TREATMENT OF PSYCHIATRIC CASES—James Reagen, M.D., Chief, PMRS, V.A. Hospital, Tuscaloosa, Ala.
CORRECTIVE THERAPY IN THE TREATMENT OF CARDIAC CASES—Joseph G. Bohorfoush, M.D., Chief, Medical Service, V.A. Hospital, Augusta, Ga.

11:30 - 12:00 — Exhibits.

AFTERNOON CHAIRMAN: George V. Devins, Past President, APMR, Long Beach, Calif.

1:00 - 1:30 — Exhibits.

1:30 - 2:30 — NATIONAL TRENDS IN PHYSICAL MEDICINE AND REHABILITATION — A.B.C. Knudson, M.D., Director, PMRS, Veterans Administration, Washington, D.C.

2:30 - 3:30 — AN AREA DIRECTOR VIEWS CORRECTIVE THERAPY—John R. Hood, M.D., Area Medical Director, Veterans Administration, Columbus, Ohio.

3:30 - 4:30 — THE FUTURE OF CORRECTIVE THERAPY John E. Davis, Sc.D., Chief, Corrective Therapy, Veterans Administration, Retired.

7:00 HONOR AWARDS NIGHT.

INVOCATION—Rev. Peter O'Donnell, S.J., Sacred Heart Church, Augusta, Ga.

PRESENTATION OF AWARDS.

John E. Davis Award.
Annual Corrective Therapy Award.
Achievement Award in Rehabilitation.
Honorary Membership Award.
California Chapter Award.
Presentation of Chapter Charters.

MASTER OF CEREMONIES—Horace B. Cupp, M.D. Area Medical Director, Veterans Administration, Atlanta, Ga.

SPEAKER — To Be Announced.

BENEDICTION — Rev. Daniel J. Churton, Chaplain, V.A. Hospital, Augusta, Ga.

FRIDAY — June 29

8:30 - 9:30 — Exhibits.

9:30 - 12:00 — A PROGRAM OF SHORT PAPERS BY PMRS PERSONNEL.

CHAIRMAN: Louis B. Hantovano, Past President, APMR, Brooklyn, N. Y.

HUMAN RELATIONS IN CORRECTIVE THERAPY—Ray Heaslet, Executive Assistant, PMRS, V.A. Hospital, Tuscaloosa, Ala.

RESEARCH FINDINGS IN TREATMENT OF CHRONIC NEUROPSYCHIATRIC PATIENTS — Paul E. Roland, Research Training Specialist, V.A. Hospital, Chillicothe, Ohio.

CORRECTIVE THERAPY ACTIVITIES—John Murphy, Corrective Therapist, V.A. Hospital, Chillicothe, Ohio.

12:00 - CLOSING REMARKS — Arthur Landy, Incoming President, Association for Physical and Mental Rehabilitation.

We Introduce Our Next President

As the Association for Physical and Mental Rehabilitation prepares for its second decade, the presidential reins of office will be turned over to Arthur Landy of Kingston, Ohio. Arthur is an outstanding therapist with extensive experience in both the functional and psychiatric aspects of corrective therapy. He has devoted considerable time to association affairs for the past several years.

Arthur Landy was born in New York City where he attended Benjamin Franklin High School. He received his bachelor's degree in health and physical education at New York University in 1941, and his Master's at the same institution one year later. He was employed for two years as a teacher in New York and performed part-time research work at the Institute for Crippled and Disabled. In 1943 he began his VA service at Lyons, N. J., and was employed at Northampton, Mass., and Sunmount, N. Y., prior to his entrance into the Army Air Force where he served as a convalescent training officer during WW II.

Upon his discharge from the Air Force, Arthur was appointed Chief, Corrective Therapy, at the Veterans Administration Hospital in Chillicothe, Ohio, a position he has held for the past ten years. In late years, he has specialized in the application of exercise and activity programs for psychiatric patients and has written professional articles in this area.

Mr. Landy's service to the association includes membership on the Representative Assembly for three years; one term as membership chairman; one term as chapter chairman and one term as vice president. During the past year he served as president-elect, assisting Mr. Deyoe with administrative matters and familiarizing himself with presidential duties.

Arthur makes hs home at 47 Oak St., Kingston, Ohio. He is married and is the father of three future CT's, David, Stephan and Alan.

SHRINKAGE OF THE HEART SIZE ASSOCIATED WITH IMPROVED CARDIOVASCULAR CONDITION DUE TO PROGRESSIVE PHYSICAL TRAINING OF THREE MIDDLE AGED MEN*

THOMAS K. CURETON, Ph.D.**

Introduction

As one type of result observed from the training of middle aged adult men we have observed a shrinkage of heart size. The causes of this are not fully established but among the hypotheses are: (1) loss of fat throughout the body; (2) reduction of abdominal contents causing a lowering of the diaphragm and an elongation of the heart and aorta; (3) toning of the heart musculature; (4) reduction of blood pressures, peripheral resistance, with less work of the heart, which in time, results in reduction of muscle size; (5) raising of the basal metabolic rate which may result in a reduction of heart size as in cases of myxedema being improved; (6) dilitation of the peripheral vessels in the muscles and lungs. Unfortunately, there is no absolute consistency to the trends. It is hoped that these cases now presented will stimulate further research. It is most impressive to note the improvements in emotional outlook, cardiovascular condition and muscular endurance which have usually accompanied the reduction of heart size associated with physical training. All of these factors are probably operative but the proportionate contribution has not been analyzed as yet. With more cases casual analysis statistics could be applied to the problem.

By the term "Progressive Physical Training" is meant the type of physical exercise which is begun easily, alternated with ample rest periods, but which gets harder and harder and lasts for six months or more to the extent of one hour of rhythmic endurance exercises per day. Walking with deep breathing is advocated to the extent of building up from 1/4 to 5 miles per day. Cycling, swimming, rowing, and all such continuous locomotive exercises are considered important. Each man was taught a series of exercises which he could do for one hour per day at home. These included flutter kicks on the front, flutter kicks on the back, side leg raisings (right and left sides), sitting tucks, sit-ups, push-ups, hops, squat jumps, running in place, sprinting in place, and practice of the step test. Such hard exercises were alternated with flexibility exercises which permitted deep breathing. This program aims to develop the blood flow to almost the limit of one's capacity within each exercise period. The work is gradual for about 20 minutes to the point of mild perspiration, then the work is heavier, and finally, it carries one to almost the limit of tolerance possible for the moment. Then week by week the work gets harder by more repetitions and more test exercises.

Subjects

Three cases are presented of middle aged men who followed this program. The first was a 50-year old insurance executive who spent five days per week in Urbana under our close supervision, taking all physical and medical tests and returning to his home in Chicago over the weekend. He petitioned to take our course in adult physical fitness on the basis of having grown soft, fat, congested and lazy. He felt that his energy was fast waning and he was beset with various minor chronic ailments. He felt so poorly that he was motivated to seek the way to regain his physical fitness which, as a former high school swimmer and diver, had been pretty good. Like thousands of other former athletes, he felt a bit ashamed to realize that he was losing his fitness. His T^1 (initial tests) and T^2 (final tests) were separated by 5 1/2 months of physical training. He was examined by our staff physician.

The second case is that of a highly paid executive, president of a large corporation controlling twelve large merchandise stores in the mid-west employing many dozens of white collar executives. He came to Urbana for the tests, then followed instructions for exercising at his home in a nearby city for a year and a half, after which he was retested. He was under the supervision of his company physician.

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The third was vice-president of the same company, another highly paid executive, who had rather recent ulcer trouble, and was a tense, tired, worried man of extreme conscientiousness. He followed the program for a year and a half under our advisement and took all the tests at the beginning and at the end of this time. This included a dietary analysis by our staff physician and the usual medical examination.

All of these subjects are now quite well, doing their work, and have kept up some of the exercising ever since. They testify to having been much improved in mental outlook, feeling younger and more energetic.

Methods of Measurement of Improvement

Standard 2-meter x-rays of the chest were taken at the University of Illinois McKinley Hospital, 1 sec. exposure for diastolic heart, both frontal and lateral views. The Levy method[1] was used for rounding off the top and bottom borders of the heart shadow, as nearly as it could be applied. The volumes were computed by the equation of Keys and Friedell[2] where, Volume (cm.^{3}) = O.63 A$^{1\ 45}$, using logarithmic computations. Comparisons were also made with the earlier Herxheimer spherical method[3 4 5] and with Liljestrand's method[6] used in Scandinavia. The Keys and Freidell method agreed quite well with the Liljestrand method as estimates of internal chamber size, whereas, Herxheimer's method gives an estimate of the external rather than the internal size. It is also possible that the ellipsoidal estimate is better than the spherical esimate for real quantitative accuracy as Keys, et. al., have analyzed the errors quite well. Still, we find that the proportionate ranking of the hearts is much the same between the two systems and we have previously reported on such comparisons.[7]

In 1951 we published our review of all of the methods used to estimate heart size. There is agreement that the methods of computation based upon systolic or diastolic area are as good as those based upon area and depth, or long X short diameters X depth. This review traces the studies from Henschen's 1896 work to the development of Bardeen's formula[8] in 1918, and on through the work of Herxheimer's[9] German work of 1923-1928, Van Liere's work[10] in 1927, Eyster's work[11] about 1930, then to the work of Keys and Friedell and their associates[12 13] in 1939-1940 which is contemporary with the work of Liljestrand[14] and Nylin[15], in Sweden.

While Keys and Friedell, et. al., in 1939 and 1940 used Roentgen kymographic technique to evaluate heart size in both the diastolic and systolic phases, deducing stroke volume from the difference and showing high correlation with Grollman stroke volume, heart size has been shown in the work of Tosky of our laboratory to be much less important than the Brachial Pulse Wave evaluation to predict endurance performance on the treadmill run for time at 7 mi./hr. and 8.6% grade. The writer sugested using the ratio of Brachial Pulse Wave/Diastolic Heart Area and this gave much better predictions of running time than Grollman stroke volume or any of 15 other cardiovascular tests.[16 17 18 19] Anatomical size was not very significant, yielding correlations in Tosky's study[20] below 0.300 compared to correlations above 0.60 for the ratio given. The Grollman stroke volume was below 0.40. The ratio of output taken proportional to the standarized Brachial Pulse Waves (as quantitated by Cureton[21]) divided by diastolic area of the frontal x-ray, or by the Keys and Friedell volume was reported in 1951.

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[1]Levy, R. L., 'Size of Heart in Pneumonia," *Arch. Int. Med.*, 32: 359-96, (July-Dec., 1923).

[2]Keys, A. and H. L. Friedell, "Size and Stroke of the Heart in Young Men in Relation to Athletic Activity," *Science*, 88: 456-58, (Nov. 11, 1938).

[3]Herxheimer, H., "Untersuchungen uber die Anderung der Herzgrosse unter dem Einflussbestimmter Sportarten," *Zeitschrift fur Klinsche Medizin*, 111: 376, (1929). Also, his section, pp. 100-113, in F. J. J. Buytendijk, "Ergebnisse der Sportarztlichen Untersuchungen bei dem IX, Olympichan Spielen in Amsterdam, 1928, Berlin: Julius Springer, 1929.

[4]Herxheimer, H., "Zum Einfluss der Radfahrens auf die Herzgrosse," *Klin. Wchnschr.*, 2: 1549 (1923).

[5]Herxheimer, H., "Zur Grosse, Form und Leistung fahigkeit des Herzens bei Sportsleuten," *Zeitschr. f. Klin. Med.*, 96: 218-35, 1923.

[6]Liljestrand, G., E. Lysholm, G. Nylin and C. G. Zachrisson, "The Normal Heart Volume in Man," *Am. Heart Journ.*, 17: 406-17, (April, 1939).

[7]Cureton, T. K., *Physical Fitness of Champion Athletes*, pp. 105-136. "Measurements of Heart Size Related to Athletic Performance," Urbana: University of Illinois Press, 1951.

[8]Bardeen, C. R., "Determination of the Size of the Heart by X-Rays," *Am. Jour. Anat.*, 23: 423-87, 1918.

[9]Herxheimer, op. cit.

[10]Van Liere, E. J., "The Effect of Anoxemia on the Size of the Heart as Studied by the X-Ray," *Am. Heart Jour.*, 82: 727-732, (Nov., 1927).

[11]Eyster, J. A. E., "Further Studies in Cardiac Hypertrophy," *Am. J. Physiol.*, 93: 647, ((1930).

[12]Keys, A., H. L. Friedell, L. M. Garland, M. F. Madrazo and L. G. Rigler, "The Roentgen Kymographic Evaluation of the Size and Function of the Heart," *Am. Jour. of Roentgenology ad Radium Therapy*, 44: 805-33, (Dec., 1940).

[13]"Measurement of the Stroke Output of the Heart by Roentgen Kymography," *Proc. of the Soc. for Exp. Biol. and Med.*, 40: 554-556, 1939.

[14]Liljestrand, op. cit.

[15]Nylin, G., "The Amount of and Change In The Residual Blood in the Heart," *Am. Heart Jour.*, 25: 598-608, (May, 1943).

[16]Cureton, T. K., "Review of Research to Determine Cardiovascular Condition (1941-50)," *Proc. Am. Assn. for Health, Phys. Ed. and Recreation*, pp. 167-177, Detroit, 1951.

[17]Cureton, T. K., "The Hearts of Athletes," *Illinois Medical Journal*, 99: 143, 1951.

[18]Cureton, T. K., "Physical Training Produces Important Changes, Psychological and Physiological," *International Symposium of Sports Medicine and Physiology* (reprinted in *Sports Medicine*, pp. 46-63, Helsinki: Finnish Assn. of Sports Medicine, 1953).

[19]Cureton, T. K., "Six Practical Techniques for Differentiating Strong Versus Weak Hearts and Circulation," *Proceedings of the Am. Assn. for Health, Physical Education and Recreation*, pp. 126, 127, Dallas, Texas, 1950.

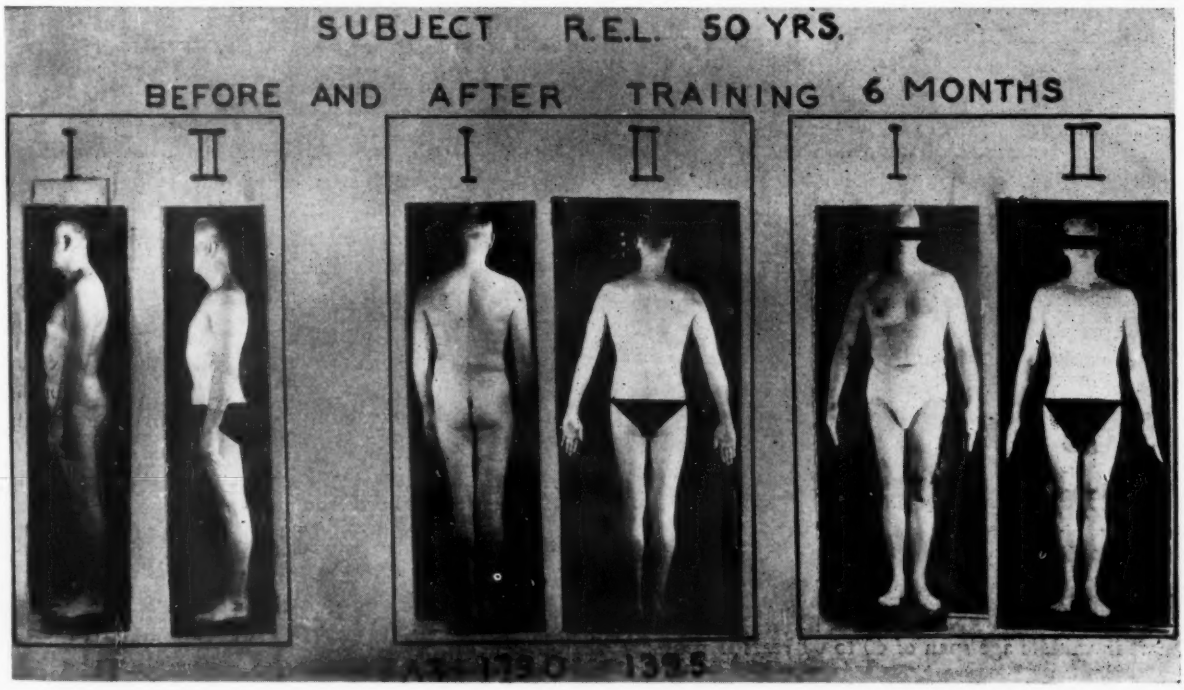
In trying to improve the Ungerleider-Clark tables for rating over-sized and under-sized hearts, Heidinger[22] of our laboratory concluded that this could be done only in a negligible amount by using any regression combination of strength, body type or muscle bulk, so we have used the Ungerleider-Clark tables in this work.[23,24] Phillips[25] also confirmed with our data that there is an average trend for heart size area to enlarge with age. The differences in frontal diastolic area over the 40 to 60-year age increments are significant. There is a reduction in size in the 60-69 year age span: the means being 20 to 29 (134.80mm.); 30-39 (137.39mm.); 40-49 (142.25mm.); 50-59 (160.00 mm.); 60-69 (154.60mm.), ($r=0.382 \pm 0.0432$ for 180 cases).

The errors of measurement (S.D. of retests) are not reported in full but our method averages in a

TRAINING DATA FOR R. L. (Part I) PHYSIQUE AND MOTOR FITNESS TESTS

Test Item		Before (Oct.)	After (Mar.)	S.S. or PerCent Change	
Age	Years	49-6	50-0		12.1%
Weight	Pounds	183.3	170.8	9	6.9%
Height	Inches	71.0	71.0	0	0 %
Exp. Chest—Abdominal Girth	Inches	6.0	9.7	27	61.7%
Adipose (Fat)	Millimeters	179.0	139.5	21	22.1%
Weighted Fat Index	Franzen Units	313.1	254.1	22	19.7%
Weight Residual	Pounds	(-4.1)	(±6.6)	16	20.1%
Vital Capacity Res.	Cu. Ins.	6	41	12	584.0%
Abdominal Girth	Inches	34.5	33.4	3	3.1%
Visual Reaction Time	Seconds	0.317	0.239	26	24.6%
Auditory Reaction Time	Seconds	0.320	0.246	25	23.1%
Combined Reaction Time	Seconds	0.304	0.243	22	20.1%
Chinning	Times	2.5	6	9	140.0%
Dipping	Times	1.0	10	40	1000.0%
Full Squat Jumps	Times	0	15	13	1500.0%
Floor Push-Ups	Times	11	15	13	27.2%
Strength	(omitted because of previous hernia)				
18-Item Test	Items	6	11	25	83.3%
All-Out Treadmill Run (5 mi./hr., 8.6%)	Seconds	127	240	17	52.9%

TABLE I



TRAINING DATA FOR R. L. (Part II) CARDIOVASCULAR TESTS

(Metabolism, Pulse Wave, Indices)

Test Item		Before (Oct.)	After (Mar.)	S.S. or PerCent	Change
Metabolism					
Metabolic Rate (Sitting)	Cal./Hr./Sq. m	32.50	39.75	9	
	L./Min.	0.230	0.265	9	
	Per Cent	(-15.58)	(+6.0)		+21.6%
Gale Metabolic Rate (from heartograph)	" "	(-1.0)	(+11.0)	12	12.0%
Heartograph					
Heartograph Area	Sq. Cm.	0.45	0.70	29	55.6%
Heartograph Area/S.A.	Sq. Cm./Sq. M.	0.219	0.363	40	65.8%
Heartograph Diastolic Surge	Cm.	0.25	0.58	115	132.0%
Heartograph Sys. Amp.	Cms.	1.50	2.39	66	59.3%
Heartograph Ob. Angle	Degrees	23	20	9	13.1%
Blood Pressures					
Lying Systolic B.P.	Mm. Hg.	110	108	3	2.7%
Lying Diastolic B.P.	Mm. Hg.	88	72	25	18.2%
Standing Systolic B.P.	" "	118	112	8	5.1%
Standing Diastolic B.P.	" "	100	80	33	20.0%
Change in Pulse Pressure (Lying to Standing)		(-14)	(±4)	14	18.0%
Pulse Rate (Sitting)	Beats/Min.	64.6	62.8	6	9.3%
Circulatory-Respiratory Tests					
Schneider Index	Units	12	15	13	25.0%
5-Min. Step Test	Beats	176	140	61	20.5%
Barach Index	Units	191.8	181	17	5.6%
Stone Index	Units	0.120	0.400	15	233.0%
Tigerstedt Index	Units	0.152	0.286	21	88.2%
Cureton CV-Factor	S. S.	62.3	71.6	9.3	14.9%
Cureton Av. Prog. P.R. (5 rates of stepping)		2.47	2.14	23	13.4%
Cureton Pulse Rate Prediction of Running		219.2	289.5	32	32.1%
Run in Place 2 ' and Hold Breath	Secs.	13	25	17	91.8%

TABLE II

series of 6 retakes gives this value as ±2.93 mm. for transverse diameter, equivalent to ±13.3 cm.^{3} for volume. Phillips obtained even smaller standard errors of measurement. This is an estimate of consistency of retakes under similar conditions on the same subject.

It would be fully granted that the method used in this work does not give the precise size of the actual heart in diastole but it is about as well as can be done in the live human being. We were disappointed that heart size does not seem to be as important as function in terms of measures of oxygen intake during work, brachial pulse waves and stroke volume by Grollman procedure. Still, the use of our ratios of Pulse Wave Area over Heart Size (by area or by volume) supports the thesis that heart size area is of some real value, and that a reduction of size in an enlarged heart in middle age span of 40 to 60 years is progress in the direction of fitness—and it is shown to agree in almost all subjects with other independent measures of fitness. The fact that heart size enlarges in young athletes under the influence of strenuous endurance training is probably due to different conditions, including much more violent activity.

Findings

1. Case I (R.L.)—50-year old insurance executive (cf. Figs. 1, 2 and Tables I, II, III). In 5½ months of sincere and regular physical training which built up, from one workout every other day, to hard endurance work afor about 2 hours per day, the volume of the heart reduced from 1174 to 822 cm.^{3}, a shrinkage of 30%. The frontal diastolic x-ray reduced from 180 to 141.1 cm.^{2}, a reduction of 26.6%. All of the various diameters and depths reduced in size. These reductions were paralleled by improvement in the Output/Size ratios (98.3% dividing P.W./Area and (122.

TRAINING DATA FOR R. L. (Part III) HEART AND CIRCULATION TESTS
(Anatomical and Physiological)

Test Item		Before (Oct.)	After (Mar.)	S.S. or PerCent Change
Anatomical Data				
Area Frontal X-Ray	Sq. Cms.	180	141.1	(-26.6)
Per Cent of Norm (Table)	Per Cent	5.5	(-2.5)	(-15)
Heart Volume (Keys & Friedel Equation)	Cu. Cms.	1174	822	(-30)
Left Diameter	Cms.	9.8	9.0	(-8.16)
Right Diameter	Cms.	4.4	4.3	(-6.52)
Transverse Diameter	Cms.	14.30	13.30	(-6.99)
Ratio L.D./R.D.		1/2.13	1/2.09	1.87
Long Diameter	Cms.	9.8	9.0	(-8.16)
Short Diameter	Cms.	14.0	13.0	(-7.14)
Depth	Cms.	13.0	12.1	(-6.94)
Herxheimer Vol. L./Kg.	1/L./Kg.	1/61.1	1/63.1	(-3.44)
Output Size				
$\frac{\text{Area Brachial P.W.}}{\text{Area Diastolic X-Ray}} \times 1000$	$Cm.^2/Cm.^2$	2.50	4.96	93.3
$\frac{\text{Area Brachial P.W.}}{\text{Volume (K. \& F.)}} \times 1000$	$Cm.^2/Cm.^3$	0.383	0.852	122.4
Functional Data				
Gross 0_2 Intake in	L./Min.	1.82	2.525	72.2
3½ Mi./Hr. TM Walk 8.6% Grade	L./Min./Kg.	0.021	0.0325	54.8
All-Out Jog on TM, 5 Mi./Hr., 8.6% Grade	Minutes	2.07	4:00+	16 89.0
R.Q. in Above		0.99	0.83	16.2
Rate of 0_2 Debt in 5 Mi./Hr. Jog	L./Min.	1.453	1.377	5.23
Net 0_2 Debt in same	L.	3.010	4.763	58.20
ECG				
R (highest)	Mm.	27.6	34	26.1%
T (highest)	Mm.	9.9	11.6	17.2%
Electrical Axis	Degs.	17°	27°	58.9%

TABLE III

4% dividing P.W./Volume). Simultaneously, the Gross 0_2 Intake in L./Min./Kg. improved by 54.8% and the actual all-out time of a Treadmill Run, 5 mi./hr./8.6% grade by 89.0%. Over the training period the 0_2 Debt capacity in Liters increased 58.2% but the Rate of 0_2 Debt decreased 5.23%. These measures indicate improved organic condition, meaning improved endurance, tolerance of exertion, etc.

This subject's weight reduced from 183.3 to 170.8 lbs. and the pinched-up caliper fat on six places of the body reduced from 179 to 139.5 mm., a reduction of 22.1% or 21 S.S. Since the weight residual increased from -4.1 lbs. to +6.6 lbs., 20.1% or 16 S.S., the muscle undoubtedly firmed up but due to a previous hernia the strength tests were not given.

The Vital Capacity Residual improved from 6 to 41 cu. ins., 584%, or 12 S.S. The Abdominal Girth reduced from 34.5 to 33.4 ins.

There were marked improvements in Total Body

[20]Tosky, R. F., 'Relationship of Heart Size to the Treadmill Run," Urbana: M. S. Thesis, Physical Education, 1951. pp. 52.

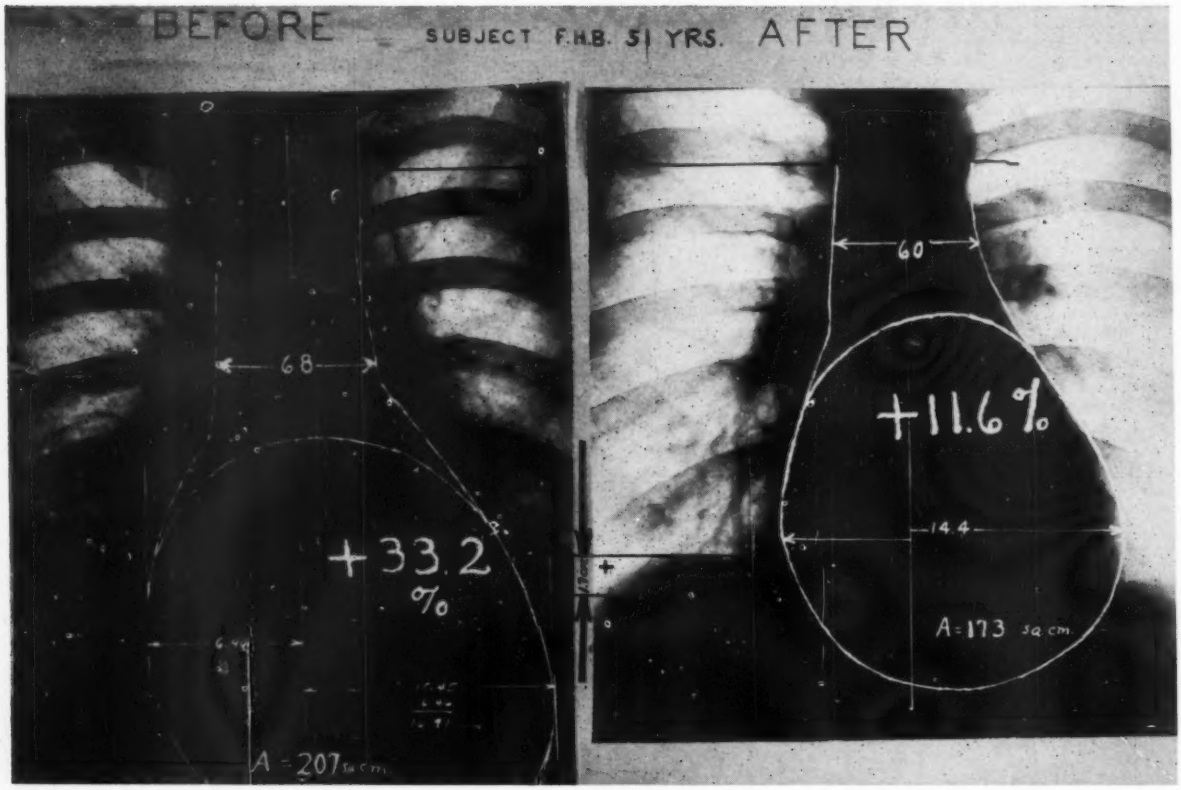
[21]Cureton, T. K., *Physical Fitness Appraisal and Guidance*, pp. 232-280, St. Louis: C. V. Mosby Co., 1947; also, pp. 228-254 of *Physical Fitness of Champion Athletes*, 1951.

[22]Heidinger, R. C., "Relationship of Heart Size to Strength, Muscle Bulk and Surface Area," Unpublished M. S. Thesis, Physical Education, University of Illinois, Urbana, 1948. Pp. 76.

[23]Ungerleider, H. E. and R. Gubner, "Evaluation of Heart Size Measurements," *Am. Heart Jour.*, 24: 494-510, (Oct., 1942).

[24]Ungerleider, H. E. and C. P. Clark, "A Study of the Transverse Diameter of the Heart Silhouette with Prediction Tables Based on the Teleroentgenograms," *Am. Heart Jour.*, 17: 92-102, (Jan., 1939).

[25]Phillips, E. E., "Heart Size of Adult Men as Related to Age," Unpublished M. S. Thesis, Physical Education, University of Illinois, Urbana, 1956. Pp. 66.



TRAINING DATA FOR F. H. B. (Part I) PHYSIQUE AND MOTOR FITNESS TESTS

Test Item		Before (Feb. 1951)	After (Nov. 1952)	S.S. or PerCent Change	
Age	Years	51	52-6		2.9 %
Weight	Pounds	162.8	172	(+7)	6.0 %
Height	Inches	73.3	73.5	(+1)	0.3 %
Weight by Metropolitan Table	Pounds	(-28.2)	(-23.0)		(+18.4) %
Exp. Chest—Abdominal Girth	Inches	6.25			
Adipose (Fat)	Millimeters	149.0	142.5	(+3)	(+4.4) %
Weighted Fat Index	Franzen Units	223.7	214.5	(+4)	4.1 %
Weight Residual	Pounds	0	(+25.5)	(+18)	
Vital Capacity Res.	Cu. Ins.	48			
Abdominal Girth	Inches	32.5			
Body Build Index		13.42	13.22	(+4)	1.5 %
Agility Run	Seconds	25.0			
Visual Reaction Time	Seconds		0.409		
Auditory Reaction Time	Seconds		0.395		
Combined Reaction Time	Seconds		0.367		
Trunk Flexion Forward	Inches		24.0		
Trunk Extension Backward	Inches		11.4		
Chinning	Times		1.0		
Dipping	Times		2.0		
Full Squat Jumps	Times				
Floor Push-Ups	Times				
Vertical Jump	Inches		15.0		
Strength	Pounds	698	754	(+3)	8.02%
Strength/Weight	lbs./lbs.	4.28	4.38	(+1)	2.34%
18-Item Test	Items	Omitted			
All-Out Step Test	Minutes		1.05		
32-34 per min.					

TABLE IV

TRAINING DATA FOR F. H. B. (Part II) CARDIOVASCULAR TESTS
(Metabolism, Pulse Wave, Indices)

Test Item		Before (Feb. 1951)	After (Nov. 1952)	S.S. or PerCent Change	
Metabolism					
Metabolic Rate (Sitting)	Cal./Hr./Sq. m L./Min. Per Cent				
Gale Metabolic Rate (from heartograph)	" "	(+31.0)%	(+2.0)%	(+38)	29%
Heartograph					
Heartograph Area	Sq. Cm.	0.43	0.44	(+1)	2.3%
Heartograph Area/S.A.	Sq. Cm./Sq. M	0.219	0.219	0	0 %
Heartograph Diastolic Surge	Cm.	0.27	0.08	(−35)	(−70.4)%
Heartograph Sys. Amp.	Cms.	1.67	1.34	(−13)	(−19.8)%
Heartograph Ob. Angle	Degrees	19.5	18.0	(+11)	(+7.7)%
Blood Pressures					
Lying Systolic B.P.	Mm. Hg.	118.0	100.0	(+22)	(+15.3)%
Lying Diastolic B.P.	Mm. Hg.	74	68	(+10)	(+8.1)%
Standing Systolic B.P.	" "	120	118	(+2.5)	(+1.7)%
Standing Diastolic B.P.	" "	80	84	(−6.0)	(−5.0)%
Change in Pulse Pressure (Lying to Standing)	" "	(+)	(+2)	(+4.0)	
Pulse Rate (Sitting)	Beats/Min.	76	69	(+10.0)	(+9.2)%
Circulatory-Respiratory Tests					
Schneider Index	Beats	15.0	14.0	(−5)	(−6.67)%
5-Min. Step Test	Units	Omitted	Omitted		
Barach Index	Units	176.0	161.6	(+5)	(+8.18)%
Stone Index	Units	0.500	0.405	(−9)	(−19.0)%
Tigerstedt Index	Units	0.333	0.288	(−8)	(−13.5)%
Cureton CV-Factor	S.S.	64.2	58.5	(−5.7)	(−8.9)%
Cureton Av. Prog. P.R.	Beats	207 (4)	170 (4)	(+19)	(+17.9)%
(4 rates of stepping)	Av. Ratio	2.192 (4)	2.358 (4)		8.48%
Cureton Pulse Rate Prediction of Running		214.5	255.8	(+19)	(+19.3)%
Step in Place 1 Min. and Hold Breath	Secs.	9	17	(+15)	(+88.9)%

TABLE V

Reaction Times, 20 to 25%, in response to light and sound signals.

Various muscular endurance tests improved from 9 to 40 S.S. and the 18-Item Motor Fitness Test improved 83.3%.

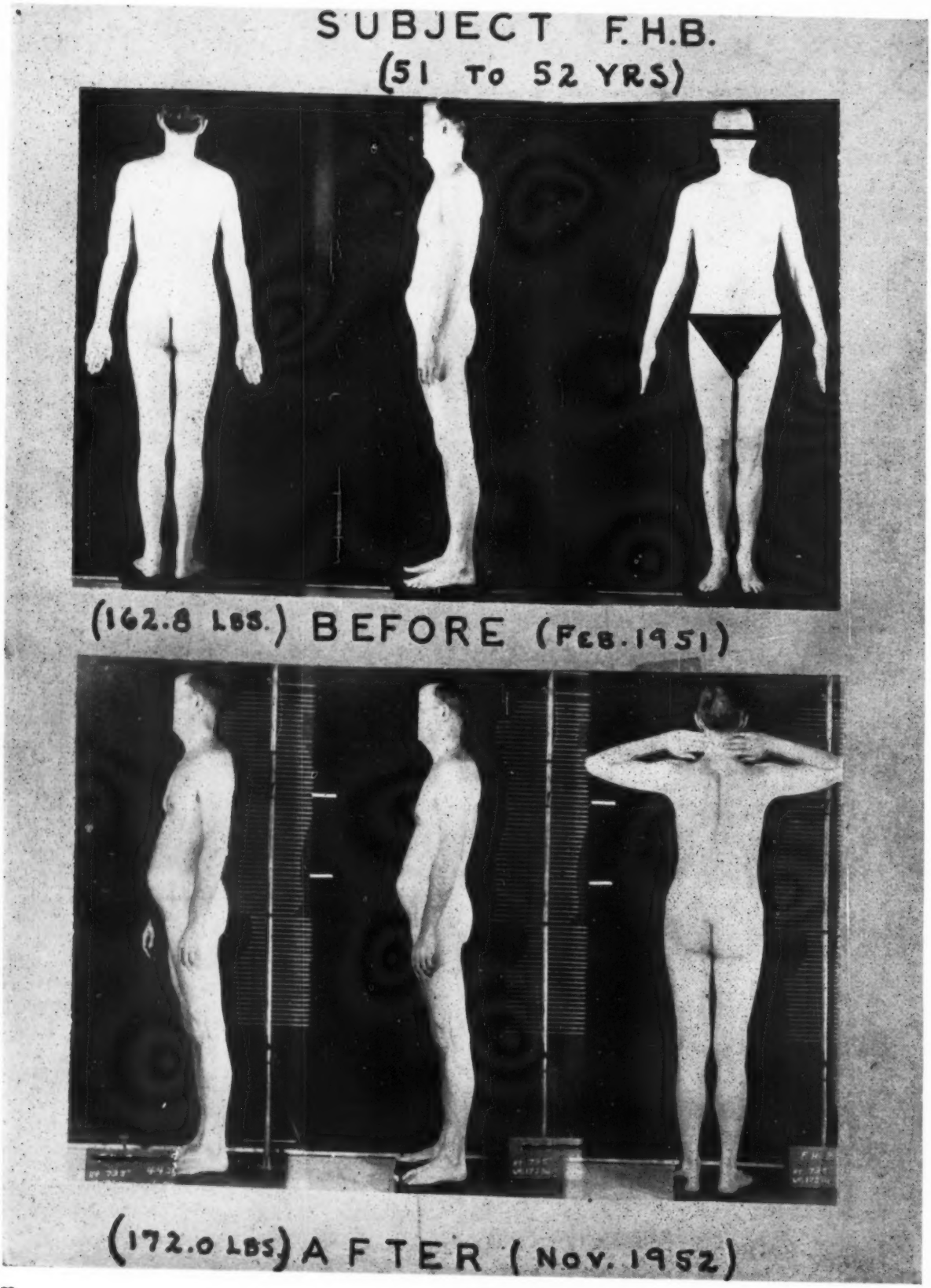
Basal Metabolic Rate increased 21.6%, or 9 S.S. The Brachial Pulse Wave increased in size from 13 to 132%, or 9 to 115 S.S., in various measurments of it. Blood pressures were reduced 2.7 to 20%, or 3 to 33 S.S. Pulse rate slowed slightly by 9.3% or 6 S.S. All other cardiovascular indices improved from 5.6% to 233%, or 9.3 to 61 S.S. Breath holding after exercise improved 91.8% or 17 S.S.

2. Case II (F.H.B.)—51-year old merchandise corporation vice-president (cf. Figs. 3, 4 and Tables IV, V, VI). In a year and a half of self-imposed physical training in a nearby city, the heart volume of this subject reduced from 1439 cm.^{3} to 880 cm.^{3}, a reduction of 40.3%. While all frontal diameters reduced, there was an increase of depth of 26.3%. The diaphragm of this subject did not drop, nor did his weight drop. The Output/Size ratios increased 22.2% for the P.W./Area and 67.9% for the P.W./Volume. No oxygen intake tests were made on this subject because he resisted the procedure, being in a very poor condition and lacking confidence.

The subject gained weight from 162.8 to 172 lbs. and lost fat from 149 to 142.5 mm. His weight residual increased from 0 to 12.5 lbs. Strength increased from 698 to 754 lbs., 8.02% or 3 S.S.

The Gale equation for Metabolic Rate increased 29% and the heartograph area and obliquity angle improved 2.3% and 7.7%, respectfully. His lying blood pressures reduced 15.3% for systolic and 8.1% for diastolic. Sitting pulse rate reduced 9.2%.

Various cardiovascular tests computed from blood pressures and pulse rates were indefinite, some gaining and some losing by a few per cent but the predictions of running endurance were better than 19.3% and the average adjustment to work was better by the Progressive Pulse Ratio Average for 4 rates of stepping by 8.48% and the total pulse counts were lower by 17.9%. Breath holding after exercise improved 88.9%. The highest pre-cordial T wave in-


SUBJECT F.H.B.
(51 TO 52 YRS)
(162.8 LBS.) BEFORE (FEB. 1951)
(172.0 LBS.) AFTER (NOV. 1952)

TRAINING DATA FOR F. H. B. (Part III) HEART AND CIRCULATION TESTS

(Anatomical and Physiological

Test Item		Before (Feb. 1951)	After (Nov. 1952)	S.S. or PerCent Change
Anatomical Data				
Area Frontal X-Ray	Sq. Cms.	207.2	173.1	16.5%
Per Cent of Norm (Table)	Per Cent	(+33.1)%	(+9.9)%	(+23.2)%
Heart Volume (Keys & Freidel Equation)	Cu. Cms.	1439	880	40.3%
Left Diameter	Cms.	10.5	8.6	18.1%
Right Diameter	Cms.	6.5	5.6	13.9%
Transverse Diameter	Cms.	16.9	14.4	14.8%
Ratio L.D./R.D.		1/1.62	1/1.54	4.9%
Long Diameter	Cms.	19.8	15.5	21.7%
Short Diameter	Cms.	16.1	13.6	14.8%
Depth	Cms.	9.9	12.5	26.3%
Aortic Diameter	Cms.	7.7	6.0	22.1%
Herxheimer Vol. L./Kg.	1/L./Kg.	1/29.3	1/20.0	31.8%
Cutput Size				
Area Brachial P.W. / Area Diastolic X-Ray X 1000	$Cm.^2/Cm.^2$	2.075	2.54	22.2%
Area Brachial P.W. / Volume (K.&F.) X 1000	$Cm.^2/Cm.^3$	0.298	0.500	67.9%
Functional Data				
Gross 0_2 Intake in All-Out Step Test, 32-34/Min.	L./Min.	Omitted	1.392	
	L./Min./Kg.	"	0.0178	
All-Out Step Test, 17", as above	Minutes		1.05	
R.Q. in Above			0.57	
Rate of 0_2 Debt in Above	L./Min./Kg.		0.0275	
Rate of 0_2 Debt in Above	L./Min.		2.150	
Net 0_2 Debt in same	L.		2.257	
ECG				
R (Highest)	Mm.	15.3	13.2	(−13.73)%
T (Highest)	Mm.	5.9	6.8	(+15.25)%
Electrical Axis	Degs.	30°	16°	(+46.7)%

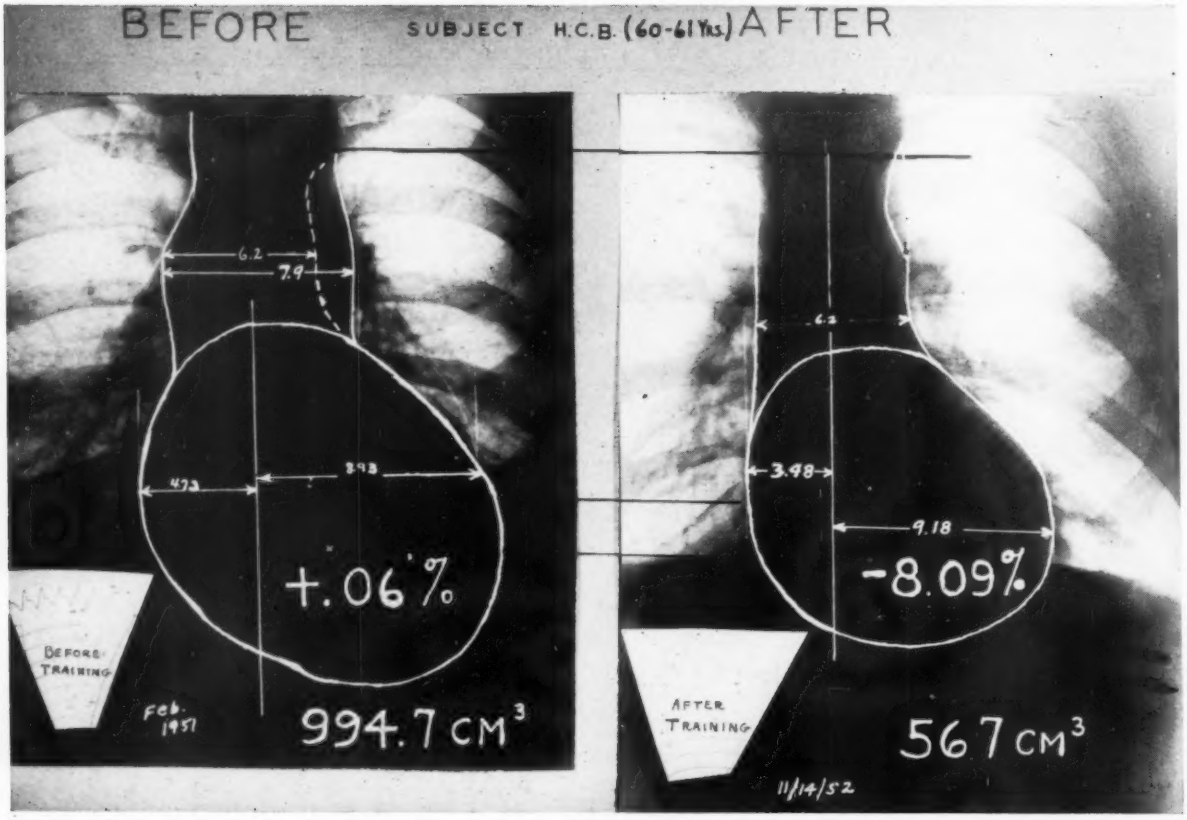
TABLE VI

creased 15.25% and the electrical axis changed from 30° to 16° indicating some reduction of right side preponderance, which agrees with the reduction of the right diameter by actual measurement.

Due to the poor condition of this subject and his aversion to strenuous tests, all motor tests were omitted other than those mentioned but with the exception of the all-out step test in which he lasted only 1.05 min. at 32-34 steps per min.

3. Case III (H.C.B.)—60-year old president of large merchandising firm. During the year, he retired and became president of the Board of Directors in this company but had numerous other financial interests (cf. Figs. 5, 6 and Tables VII, VIII, IX). In the year and a half of physical training carried out by himself in a nearby city, his heart volume reduced from 994.7 $cm.^3$ to 567.0 $cm.^3$, a reduction of 43.0%. The planimetered area reduced from 160.6 $cm.^2$ to 109.0 $cm.^2$, or 32.1%. All diameters reduced but the right transverse and the depth. There was some lowering of this man's diaphragm, a slight reduction of 2 pounds of weight and an appreciable reduction of adipose tissue from 172 to 141 mm., 18.0% or 19 S.S. His weight residual increased from 4.95 lbs. to 10.6 lbs., a gain of 9 S.S. Strength improved from 951 to 1068 lbs., or 12.3%.

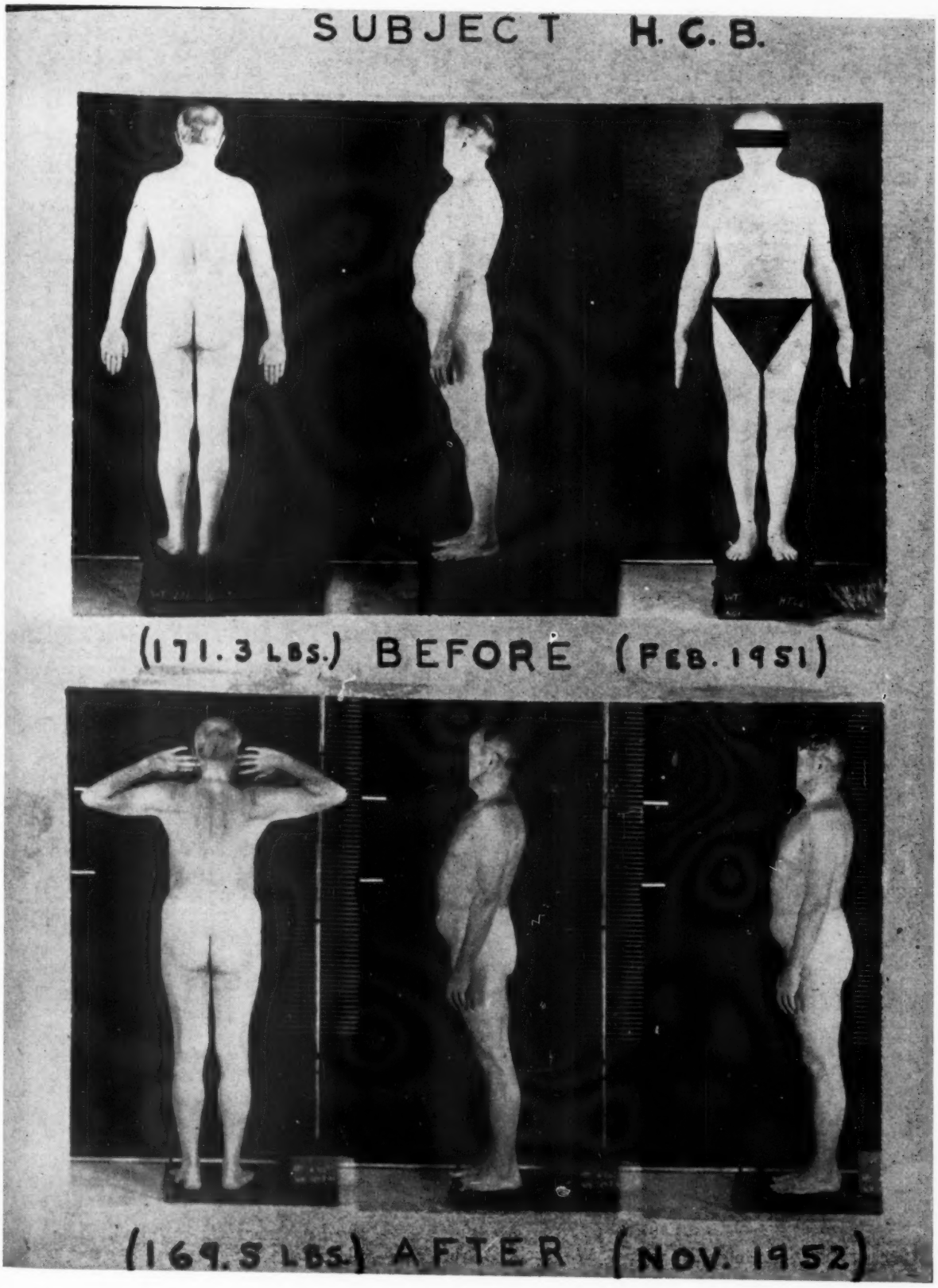
There were important gains in cardiovascular efficiency. The Output/Size ratios improved 92.7% (P.W./Area and 128.3% (P.W./Volume). The Oxygen Intake Test was given only on the second round of testing at the end of his training because he preferred not to take it the first time, being quite tired from the other tests and having only two days to give to the tests and medical examination.



TRAINING DATA FOR H. C. B. (Part I) PHYSIQUE AND MOTOR FITNESS TESTS

Test Item		Before (Feb. 1951)	After (Nov. 1952)	S.S. or PerCent Change	
Age	Years	60	61—6		2.50%
Weight	Pounds	171.5	169.5	(+2)	1.17%
Height	Inches	67.0	67.0	0	0
Weight by Metropolitan Table	Pounds	(+13.3)	(+11.5)		13.5%
Exp. Chest—Abdominal Girth	Inches	3.7	3.5	(−5)	(−5.4)%
Adipose (Fat)	Millimeters	172	141	(+19)	(+18.0)%
Weighted Fat Index	Franzen Units	259.3	244.2	(+9)	(+5.8)%
Weight Residual	Pounds	(+4.95)	(+10.6)	(+10)	
Vital Capacity Res.	Cu. Ins.	(−25)			
Abdominal Girth	Inches	36.0	35.2	(+4)	(+2.2)%
Visual Reaction Time	Seconds	Omitted	0.389		
Auditory Reaction Time	Seconds	"	0.341		
Combined Reaction Time	Seconds	"	0.337		
Trunk Flexion Forward	Inches	"	11.1		
Trunk Extension Backward	Inches	"	10.4		
Chinning	Times	"			
Dipping	Times	"			
Full Squat Jumps	Times	"			
Floor Push-Ups	Times	"			
Strength	Pounds	951	1068	(+9)	(+12.3%
Strength/Wt.	Lbs./Lbs.	5.55	6.30	(+11)	(+13.5)%
18-Item Test	Items	Omitted			
All-Out Step Test (34-36 per Minute)	Minutes		1.05		

TABLE VII


SUBJECT H.C.B.
(171.3 LBS.) BEFORE (FEB. 1951)
(169.5 LBS.) AFTER (NOV. 1952)

TRAINING DATA FOR H. C .B. (Part II) CARDIOVASCULAR TESTS

(Metabolism, Pulse Wave, Indices)

Test Item		Before (Feb. 1951)	After (Nov. -952)	S.S. or PerCent Change	
Metabolism					
Metabolic Rate	Cal./Hr./Sq. m.	Not taken	40.2		
(Sitting)	L./Min.	Not taken	0.256		
	Per Cent	Not taken	(+10.1)%		
R.Q. in above		Not taken	0.70		
Gale Metabolic Rate (from heartograph)	" "	(−9)%	(+11)%	24	(+19)%
Heartograph					
Heartograph Area	Sq. Cm.	0.33	0.48	19	45.5%
Heartograph Area/S.A.	Sq. Cm./Sq. M	0.175	0.256	27	46.3%
Heartograph Diastolic Surge	Cm.	0	0.09	67	
Heartograph Sys. Amp.	Cms.	1.05	1.32	11	25.7%
Heartograph Ob. Angle	Degrees	23.8	21.5	17	9.7%
Heartograph Diastolic Amp.	Cms.	0.63	0.81	15	28.6%
Blood Pressures					
Lying Systolic B.P.	Mm. Hg.	112	132	(−34)	17.9%
Lying Diastolic B.P.	Mm. Hg.	78	82	(−5)	5.1%
Standing Systolic B.P.	" "	118	122	(−5)	3.4%
Standing Diastolic B.P.	" "	78	82	(−5)	5.1%
Change in Pulse Pressure (Lying to Standing)	" "	(+12)	(−12)	(−27)	
Pulse Rate (Sitting)	Beats/Min.	64	64	0	0 %
Circulatory-Respiratory Tests					
Schneider Index	Units	12	14	10	(+16.7)%
5-Min. Step Test	Beats	Omitted	Omitted		
Barach Index	Units	159.6	187.5	(−15)	(−17.5)%
Stone Index	Units	0.639	0.270	(−37)	(−57.8)%
Tigerstedt Index	Units	0.390	0.213	(−43)	(−45.4)%
Cureton CV-Factor	S.S.	69.3	80.7	(+11.4)	(+16.5)%
Cureton Av. Prog. P.R.	Beats	222	162		(+27.0)%
(5 rates of stepping)	Av. Ratio	2.342	2.148	(+15)	(+8.3)%
Cureton Pulse Rate Prediction of Running	Points	259.8	233.5	(−12)	(−10.1)%
Step in Place 60" and Hold Breath	Secs.	11.0	13.0	(+6)	(+18.2)%
Expiratory Force	Mm. Hg.	120	150	(+15)	(+25.0)%

TABLE VIII

The Gale Metabolic Rate Test improved from −9% to +11.0%, a gain of 19%. The heartographs area increased 45.5%, as did all of the measures of the pulse wave. His lying and standing blood pressures increased somewhat, while his sitting pulse rate remained the same. The Schneider Index improved 16.7%, the Cureton CV Factor improved 16.5% along with the Av. Progressive Pulse Ratio 27.0%. Breath holding improved 18.2% after the 1-min. step test and expiratory force improved 25.0%. There were losses in the Barach, Tigerstedt and Stone Indices due to the blood pressures being somewhat increased.

The subject was judged incapable of doing any all-out effort when he took the first series of tests in 1951 but in 1952 he did 1.05 min. on the step test at 34.36 steps/min.

Implications of Study—Discussion

Dr. J. B. Wolffe in papers with G. W. Mueller[26] and V. A. Digilio[27] has shown the trend for heart size to increase with age. This has been confirmed by Hilbish and Morgan[28] in 1952 and by Phillips[29] in 1956. Most doctors have had some apprehension about such heart enlargement over the years. Physical training has been shown to reduce the heart size, whereas, such progressive enlargement with age has accompanied rising peripheral resistance in the aortic tree, increasing fat on and in the body, and loss of cardiovascular function, especially during hard work. In general, it is shown that such progressive physical training improves cardiac function and work ca-

[26]Wolffe, J. B. and G. W. Mueller, "The Heart of the Athlete," *The Physical Educator*, 6: 2, 305, (May, 1949).

[27]Wolffe, J. B. and V. A. Digilio, "Heart in the Athlete," *Jour. of Health, Phys. Ed. and Rec.*, 20: 8-9, (Jan., 1949).

[28]Hilbish, T. F. and R. H. Morgan, "Cardiac Mensuration by Roentgenologic Methods," *Am. J. of Med.*, 224: 586-596, 1952).

[29]Phillips, op. cit.

TRAINING DATA FOR H. C. B. (Part III) HEART AND CIRCULATION TESTS

(Anatomical and Physiological)

Test Item		Before (Feb. 1951)	After (Nov. 1952)	S.S. or PerCent Change
Anatomical Data				
Area Frontal X-Ray	Sq. Cms.	160.6	109.0	(−32.1)%
Per Cent of Norm (Table)	Per Cent	(+0.06)	(−8.1)	(−8.16)%
Heart Volume (Keys & Freidel Equation)	Cu. Cms.	994.7	567	
Left Diameter	Cms.	8.9	9.18	3.2%
Right Diameter	Cms.	4.7	3.5	(−25.5)%
Transverse Diameter	Cms.	13.7	12.5	(−8.8)%
Ratio L.D./R.D.		1/1.89	1/2.62	(−38.6)%
Long Diameter	Cms.	16.3	13.6	(−16.6)%
Short Diameter	Cms.	12.7	11.3	(−11.2)%
Depth	Cms.	12.6	14.7	(16.7)%
Herxheimer Vol. L./Kg.	1/L./Kg.	1/58.5	1/76.1	(−30.1)%
Output Size				
$\frac{\text{Area Brachial P.W.}}{\text{Area Diastolic X-Ray}} \times 1000$	$Cm.^2/Cm.^2$	2.05	3.95	92.7%
$\frac{\text{Area Brachial P.W.}}{\text{Volume (K. \& F.)}} \times 1000$	$Cm.^2/Cm.^3$	0.332	0.758	128.3%
Functional Data				
Gross 0_2 Intake in All-Out Step Test, 34-36/Min.	L./Min.	(Unable)	1.523	
	L./Min./Kg.	Omitted	0.0198	
All-Out Step Test as above	Minutes	"	1.05	
R.Q. in Above			.62	
Rate of 0_2 Debt in All-Out Step Test	L./Min./Kg.	"	0.0391	
Rate of 0_2 Debt in same	L./Min.	"	3.145	
Net 0_2 Debt in same	L.	"	3.156	
ECG				
R (highest)	Mm.	36.7	30.7	(−16.4)%
T (highest)	Mm.	13.8	9.1	(−34.0)%
Electrical Axis	Degs.	20°	24°	(+20.0)%

TABLE IX

pacity. Reduction in heart size is thus interpreted to be a trend in the direction of improved fitness. Reduced heart size may be due mainly to development of relatively greater capillarization in the muscles and lungs and to more "openness" in the small vessels all over the body associated with sympathetic dilitation.

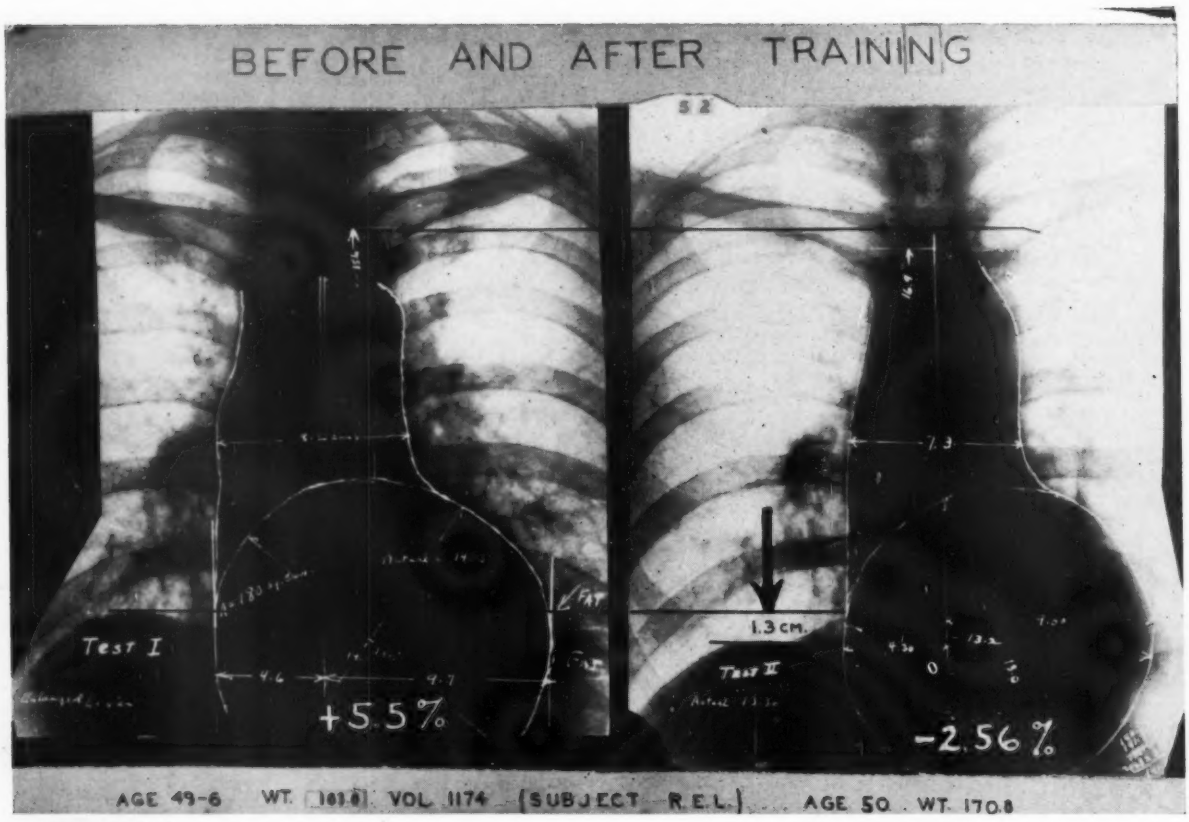
With younger samples of athletes, Herxheimer demonstrated that endurance athletes typically have larger hearts than sprint athletes with this method of spherical heart related to kilograms of body weight. Our own studies have confirmed this trend with more recently improved mensuration techniques.

Tanner[30] using the Liljestrand method of measuring the hearts indicated that some hearts do enlarge under athletic training but go back to normal size after a year. In our 1948 study of Olympic athletes, a trend was shown to indicate the usual enlargement of the right diamter in 200 m. swimming and middle distance running. We have x-rays of Roger Bannister, Jesse Owens, Gil Dodds, Bob Rehberg, Herb McKenley, John Toomey and many other track champions who show some enlargement, but it is not certain that athletics produced this at all. We certainly cannot point to Roger Bannister's heart as an inefficient one in spite of its being 25% over-sized. The racing greyhound has been reported to have an enlarged heart. We have found some world record swimmers like Joe Verdeur, holder of many world breast stroke recmarks, and also Carter, Sohl and Ris, all members of the U. S. 1948 Men's Olympic Swimming Team, with small hearts.

Comments by Ernst Jokl, M.D.

"The presentation by Dr. Cureton of x-ray pic-

[30]Tanner, Lauri, (Helsingfors), "Some Notes on Medical Research Into Athletics in Finland," Stockholm: Kongressen, Lingiaden, 1949, II: 192-96.



tures of hearts which became reduced in size after a period of physical training raises important issues. The size of a heart as such is of limited importance as an indicator of functional ability or disability unless extreme measurements are in evidence. None of the three hearts studied by Dr. Cureton were abnormally large. At the same time, it must be realized that champion athletes usually have hearts which are slightly larger than average, especially if subjects are examined who excel in performances demanding endurance. Sir Adolphe Abrahams goes so far as to say that no outstanding long distance runner has ever been encountered who did not have a slightly enlarged heart. And Herxheimer, Reindell, Roesler and others have published evidence to the effect that top-level athletes' hearts tend to reduce in size when training is discontinued."

"What then can we say about Dr. Cureton's findings? I think we must take into account that the three men had been untrained when they started their exercise program, that they were middle aged, and that they did not represent the athletic champion class. Under the circumstances, the possibility has to be taken into account that the hearts' functional burden was lightened as a result of the improvement of fitness brought about by the training. Eppinger, Kisch and Schwarz, in their classical monograph "Das Versagen des Kreislaufs" (Springer, Berlin, 1927) pointed out that size and function of the heart is significantly influenced by peripheral processes, such as rate of production of lactic acid in the tissues, permeability of capillary membranes for oxygen and carbon dioxide, autonomic control of blood vessels, etc. Eppinger, Kisch and Schwarz confined themselves to the discussion of clinical aspects. But all of the above as well as other peripheral components of the exercise process are favorably influenced by physical training, and it is quite conceivable that a state of affairs is thus brought about in which the heart, because of the improved mechanical metabolic and related condition, reduces in size. In other words, Dr. Cureton's evidence invites new studies pertaining to the cardiac as distinguished from the peripheral contribution to the total circulatory performance."

"Since the former can now be studied almost in isolation through ballisto-cardiography, a new chapter in the analysis of the effects of training on the cardiovascular system would seem to open."

Cureton

In various studies of hard physical training on young men lasting three months or more in work-

(Cont'd on P. 98)

A CHECKOUT PROCEDURE FOR BELOW-KNEE ARTIFICIAL LIMBS*

MARSHALL A. GRAHAM, M.S.**

HERBERT E. KRAMER**

There has been a growing trend in recent years to utilize the services of amputation clinics in the rehabilitation of amputees. These clinics, whose personel include physicians, therapists, and prosthetists, have responsibilty for the physical and prosthetic rehabilitation of the patient. Their responsibilities do not end with the prescription of a prosthesis, but include an evaluation of the adequacy of the prosthesis and training before the patient proceeds to subsequent phases of the rehabilitation program. It is known that an inadequate limb can result in insurmountable training problems and can hinder the physical, emotional, and vocational adjustment of the amputee.

Recently, as part of a nationwide research and educational program in upper extremity prosthetics, a checkout procedure for artificial arms was devised. The emphasis in prosthetic education has shifted from the upper extremities to the lower extremities. New York University and the University of California in cooperation with the Veterans Administration are developing lower extremities courses coordinated by the Prosthetic Research Board of the National Research Council. These courses for physicians, prosthetists and therapists in addition to teaching fabrication, prescription, and training will include technics of evaluation of lower extremity prostheses.

The major portion of the upper extremity procedure consisted of a check list of questions concerned with minimally acceptable prosthetic standards. If all the questions were answerable in the affirmative, the prosthesis was considered to be acceptable. Any questions answered in the negative immediately pointed up a deficiency in the prosthesis.

In view of the success of the upper extremity checkout as an integral part of clinic procedure and as a result of many requests from physicians and

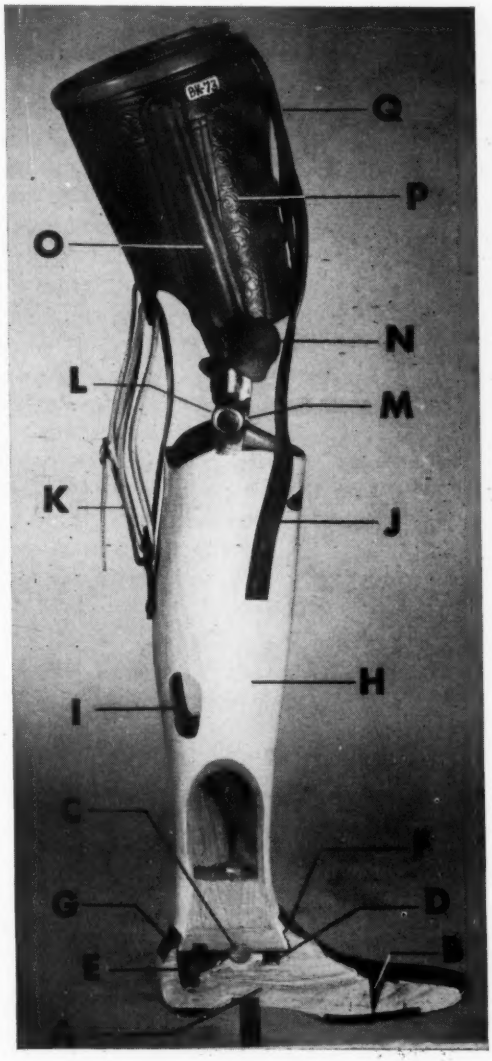


Fig. 1

Legend

A. Foot
B. Toe-break
C. Ankle joint and bushing
D. Front ankle bumper (rubber or felt; acts as dorsiflexion stop)
E. Rear ankle bumper (rubber; for plantar flexion)
F. Anterior ankle articulation space (leather covered)
G. Posterior ankle articulation space (leather covered)
H. Shank (shin)
I. Air vent of shank
J. Fork strap
K. Check Lacer
L. Knee joint
M. Knee joint extension stop
N. Knee joint cover
O. Thigh brace (leather covered)
P. Thigh corset (leather)
Q. Attachment strap or fork strap to waist belt

*This is the first of two articles concerned with checkout procedures for lower extremity artificial limbs. The second article will deal exclusively with the above-knee prosthesis.

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therapists throughout the country, the authors have attempted to develop a check list by which the adequacy of a below-knee prosthesis can be determined. This check list pertains primarily to a conventional below-knee prosthesis as presented in Fig. 1. Although many variations are found, a conventional below-knee artificial limb is usually comprised of a wooden foot with toe-break; an ankle with provision for dorsi- and plantar flexion (although some also make provision for inversion and eversion); a wooden, metal, fiber or plastic shank; a carved wooden, metal or molded leather or plastic socket; metal side braces with single axis knee joints; and a leather thigh corset. In addition, many below-knee amputees wear a waist belt with a fork strap attached to the shin, as an aid to retaining the limb on the stump, and a leather check lacer to control the knee joints in extension.

In this article, each italicized question represents a point to be checked by the clinic group. A brief discussion follows the question with occasional hints for correction of a subpar condition. A work sheet for clinic use can be easily drawn from the information contained in this article, supplemented by the reader's experience. A suggested form for the work sheet has a short underlined space preceding each numbered question, so that a check (✓) or a "no" may be inserted as each item is covered at the clinic. The remedy for items that prove to have shortcomings may be obvious, in which case extensive discussion by the clinic group is unnecessary. It is the opinion of the authors that a checkout procedure such as this can facilitate the clinic functions by methodically emphasizing the most important factors in the prosthesis.

The reader should be cognizant of the fact that this article concerns itself solely with the determination of prosthetic adequacy. The entire area of functional adequacy of the amputee with this prosthesis as a concommitant of training and practice, is deserving of special treatment and is not covered in this article.

The check list which follows has been divided into four areas considered to be of major importance The first area, quality control, is concerned with examination of the prosthesis before it is worn by the patient. The second area is concerned with the prosthesis worn by the amputee while standing. The third area is concerned with the prosthesis worn by the amputee while sitting. The fourth and last area is related to the prosthesis worn by the amputee while walking. Any shortcomings of the prosthesis should be corrected and the limb rechecked by the clinic prior to the start of training.

A. Quality Control

1. *Is the color of the leg satisfactory and homogeneous?*
2. *Hsa the inside socket surface been completely and smoothly finished, and has a wood sealer been applied to the entire surface?*

In a wood socket, a wood sealer will prevent perspiration from the stump from penetrating the wood causing rough spots, rising of the grain, or cracking of the socket, any of which can cause stump irritation. A good finish will permit adequate hygienic care by allowing residual perspiration to be removed easily from the socket surface.

3. *Has the socket rim been adequately flared and all sharp edges smoothed?*

A sharp inside edge of the socket rim can cause discomfort and even laceration of the skin, especially in the case of obese amputees whose skin folds may overlap the socket.

4. *Is there a protetcive cover over the medial and lateral knee joint heads to prevent catching or tearing of trousers?*

This has been a continuing problem for below-knee amputees. Leather or plastic caps are available for placement over the joint heads.

5. *Do the knee joints articulate smoothly without resistance or excessive lateral play?*

Excessive resistance will cause undue wear on the joint, shortening the maintenance-free period of wear. It will also force the amputee to exert more stump effort to extend the knee, resulting in more rapid fatigue. A loose joint can damage the bearings or, as a result of undue strain, cause a cracked joint. Rough action of the joints may be an indication of cracked or worn ball bearings, dirt, or lack of lubrication. Very often, noise will be associated with these conditions.

6. *Do both side braces come into contact with the knee extension stops simultaneously?*

Uneven contact of the knee extension stops will cause internal or external rotation of the prosthesis each time the knee reaches full extension in addition to causing uneven strain on the joints.

If a check lacer is worn, uneven setting of the joints may at first be overlooked. Usually a check lacer is used to prevent the clicking noise that occurs as the prosthetic knee reaches full extension. However, as the leather stretches, contact occurs at the knee stops and the deleterious effect of improperly set knee joints will become apparent. (Note: it has been the experience of the authors that check lacers can be elminated in many below-knee prosthesis. Generally, a lacer should be included on artificial limbs only for patients with short stumps and/or with knee

instability due to weak ligamentous structures. For other patients, elimination of a joint click can be accomplished by filing the knee extension stops and/or by the amputee resuming control of his knee so as to limit extension before the joint stops make contact.)

7. *Does the distance between the medial and lateral thigh braces remain constant during full flexion and extension?*

Inconsistant spacing between the thigh portion of the side bars during flexion and extension is an indication of misalignment of the knee joint heads. The joint heads should be perpendicular to an imaginary line through their centers and parallel to the line of progression of the prosthetic swing. Improper joint alignment will tend to distort the thigh corset and will influence the prosthetic swing while walking. It can contribute also to uneven wear of the knee joints and breakage of the thigh portion of the side bars.

8. *Is the brace and corset approximately* 1 *inch higher on the lateral side than on the medial side?*

The higher lateral shaping of the thigh corset will provide a better support for the muscles of the hip (which control movements of the femur) to work against, providing lateral stability.

The anatomical structure of the femur cases the body weight to lean laterally during the stance phase. This becomes exaggerated in amputees with the loss of muscular control at the base of support (foot and ankle).

9. *Has the thigh corset been finished in a workmanlike manner, i.e. lined, coated for resistance to perspiration, and sewn and riveted neatly?*

10. *Is there adeqaute clearance at the ankle articulation to prevent rubbing of parts or catching of socks?*

Too little clearance will cause rubbing of the inside surface of the foot on the ankle block which will cause noise. Too much clearance will allow sock material to catch, causing tearing and/or restriction of ankle movement.

11. *Has the artificial foot been properly upholstered and fitted to the shoe?*

Neat upholstery, with no "sharp" seams will do much to prevent tearing of socks. In addition, if the foot is too small, slippage of the shoe can cause tearing of socks. There also will be a tendency for the heel of the shoe to scuff the ground during the prosthetic swing phase.

12. *If used, do the fork strap and/or check strap have sufficient adjustment range? (Check length and holes on straps.)*

B. STANDING

1. *Is the amputee secure while standing on the prosthesis with good posture and with heels touching?*

The amputee should feel that the prosthesis will remain directly under him while he is standing with his weight evenly distributed on both feet. If he feels that he is being forced backward, the prosthetic ankle may be set in too much plantar flexion. If he seems to be thrown forward and there is a tendency for the knee on the prosthetic side to buckle, the ankle may be set in too much dorsiflexion. If his weight is on the outside of the foot, the ankle is set in too much inversion; if his weight is on the inside of the foot, the ankle is in too much eversion.

2. *Is the amputee comfortable while standing on the prosthesis with good posture and with heels touching?*

Special attention should be directed to excessive pressure in such common areas of socked discomfort as:

a) porterior and distal to the head of the fibula
b) tibial tuberosity
c) anterior, distal tibia
d) anterior rim of the socket (in the area of the patellar ligament)

In addition, the amputee should not experience a choking sensation about the distal portion of the stump.

3. *Is the artificial leg the correct length?*

Incorrect length of the prosthesis can be determined by visual examination of the anterior-superior iliac spines or the superior iliac crests. The usual method of this examination is for the examiner to place his thumbs on the spinous processes or to place the hands on the crests of the ilium, and by sight, judge whether or not they are level.

If the height is not correct, the use of prepared flat wooden slabs of varying thicknesses is helpful in determining the amount of correction necessary to attain the correct prosthetic length.

4. *Is the anterior rim of the socket properly contoured to allow medial and lateral movements of the patella?*

A narrow or high anterior rim of the socket that restricts lateral movement of the patella will generally force the patella upward causing the patellar ligament to be stretched. The amputee will experienc discomfort because of jarring pressures on the patellar ligament at heel contact.

5. *Does the posterior rim of the socket extend high enough to prevent the formation of a popliteal flesh roll?*

Experience has shown that keeping the posterior

wall of the socket high enough to encase the flesh of the distal popliteal region reduces the tendency toward formation of a fleshy roll. A popliteal flesh roll can present a difficult fitting problem and restrict knee flexion.

6. *Do the side braces conform closely to the contour of the knee and thigh?*

Well-contoured side bars that provide a gripping action (without undue pressure) in the supracondylar region of the thigh will minimize the piston action of the socket on the stump, provide some lateral stability, and result in a more cosmetically acceptable prosthesis.

7. *Does the thigh corset fit snugly, with adequate adjustment for increasing the corset tension?*

There should be an opening of approximately 1 to 1½ inches between the corset borders. The adjustability of the thigh corset is particularly important for patients whose body weights fluctuate, and for recent amputees where considerable atrophy of the thigh may be anticipated. A thigh corset that cannot be tightened will become loose with thigh atrophy, disturbing the customary weight distribution between the corset and socket.

8. *Is the general shape of the prosthesis cosmetically acceptable?*

To be cosmetically acceptable, a below-knee prosthesis should approximate the shape and size of the non-amputated shin, ankle, and foot.

C. SITTING

1. *Is the amputee comfortable while sitting?*

This question is of a general nature. The various comfort factors are specifically covered in questions 2 to 6.

2. *Can the amputee sit with a minimum of 90 degree flexion and with his prosthetic foot flat on the floor?*

It should be posibsle for an amputee to sit comfortably in restricted areas, such as motion picture theatres and buses. In addition, restriction of knee flexion can cause the amputee's prosthetic foot to extend before him in a cosmetically unaceptable manner. There is also the danger of others tripping over an extended foot.

3. *Has the socket been properly shaped to prevent crowding in the hamstring and popliteal areas?*

Symptoms of improper socket contour are tingling and numbness of the stump and/or pressure of the socket rim on the medial (semimembranosus and semitendinosus) or lateral (biceps femoris) distal tendons. If such symptoms become evident, relief is usu ally indicated at the medial and/or lateral aspects of the posterior socket rim. In addition, socket pressure in the popliteal region indicates that the apex of the posterior socket rim is too high.

4. *Has the corset been properly shaped to prevent crowding in the hamstring and popliteal areas?*

An improperly shaped posterior distal thigh corset will cause bunching and irritation of flesh in the upper portion of the popliteal area. The distal corset should have an ox-bow shape with a cut-out for the ligaments high enough to prevent restriction of their normal function.

5. *Does the stump remain firmly situated in the socket while the amputee is sitting?*

The stump should not pull out of the socket or away from the anterior socket wall when the amputee is seated with knees flexed to about 90 degrees.

If the stump tends to pull out of the socket, it is an indication that the knee joints are placed higher than knee center and/or the posterior rim of the socket is too high.

If the stump tends to pull away from the anterior wall of the socket (gapping), it is an indication that the knee joints have been placed too far posteriorly. This is often accompanied by excessive pressure at the anterior distal tibia.

6. *Are both knees reasonably level while the amputee is sitting?*

For the below-knee amputee, this is a function of the correct length of the shank of the prosthesis as well as the correct positioning of the prosthetic knee joints.

D. WALKING

1. *Is the amputee comfortable while walking? (If not, specify areas of discomfort.)*

Special attention should be directed to certain common areas of discomfort and irritation (see question 2 under the heading, Standing:)

a) posterior and distal to the head of the fibula
b) tibial tuberosity
c) anterior, distal tibia
d) anterior rim of the socket (in the area of the subpatellar ligament)

The authors believe that these areas are worthy of emphasis since discomfort will become most evident when walking. The amputee's comments should be related to a careful examination of the stump at the conclusion of the walking phase of the checkout procedure.

2. *Is the amputee secure while walking?*

The amputee should feel that the prosthesis remains directly under him during stance phase with little or no tendency to shift his body weight laterally or medially. Lateral instability, usually associated with a shifting of the entire prosthesis laterally as full weight is taken on the artificial limb, may be cor-

rected by increasing the amount of valgus (knock) of the prosthesis. This is accomplished by bending the upper portion of the side braces. Displacing the prosthetic foot laterally on the shin is another way of widening the support base. The latter method, although more difficult, will not influence the positioning of the stump within the socket, whereas bending of the side bars may result in stump discomfort. Conversely, medial instability (which is less prevalent) is corrected by increasing the varus (bow) of the prosthesis, or displacing the foot medially.

Anterior-posterior stability is primarily a function of the foot-shin relationship. General prosthetic practice has aligned the foot on the shin at an angle of slightly less than 90 degrees of dorsiflexion. Excessive dorsiflexion will cause the amputee to flex his knee prematurely while walking, resulting in a "dipping" gait and giving the impression of too short a prosthesis. Excessive plantar flexion will cause difficulty in transferring weight over the ball of the foot, resulting in an irregular gait and giving the impression of too long a prostehsis.

3. *Does the prosthesis swing in a straight line of progression?*

The three major variations of the swing of a prosthesis in the sagittal plane are:

a) medial whip

b) lateral whip

c) circumduction

A medial whip is characterized by a movement of the heel of the prosthetic foot medially and a rotation of the knee laterally, which can best be observed immediately after toe-off. The foot than rotates back to its usual position either during the remainder of the swing phase (causing a "fish tail" effect), or as the heel of the prosthesis is contacting the ground with the toe rotating medially. A medial whip can usually be corrected by moving the upper portion of the medial side brace posteriorly on the thigh lacer.

A lateral whip is the reverse of a medial whip, with the heel of the foot moving laterally and the knee rotating medially immediately after toe-off of the prosthesis. A lateral whip can usually be corrected by moving the upper portion of the medial side brace anteriorly on the thigh lacer.

Circumduction is a movement of the prosthesis in a lateral arc from a straight line of progression. Circumduction is seldom seen with below-knee amputees, but if present can be caused by the amputee walking with little or no knee flexion and so moving his prosthesis outward to insure that the foot clears the ground.

4. *Is the toe-out of the prosthetic foot the same as that of the normal foot?*

5. *Does the amputee walk with a reasonably narrow base of support?*

In evaluating this item, each amputee must be considered as an individual. The length of his stump and his general body type must be taken into consideration. It is to be expected, for instance, that an obese person will walk with greater natural abduction than one who is thin or muscular.

In order to increase lateral stability, it has been the practice to fit very short below-knee stumps with a prosthesis set in exaggerated valgus (the prosthetic foot outset), which produces an effect of abduction.

There is no reason why the average below-knee amputee with no special physical or prosthetic complication cannot walk with his base of support as narrow as that of the nonamputee. This is usually between ½ and 2 inches.

6. *While walking, is the plantar surface of the prosthetic foot flat on the ground during stance phase?*

Observation of the attitude of the foot during the prosthetic stance phase will show whether the foot has been properly aligned on the shin. An everted or inverted foot will cause uneven wear of the sides of the sole of the shoe and may be the cause of lateral instability. Plantar and dorsiflexion have already been discussed (see question 2 under the heading *Walking*).

7. *Is the resistance of the ankle to plantar flexion properly set to prevent foot-slap or external rotation immediately after heel contact?*

If there is too little resistance (caused by too soft a rear ankle bumper) the prosthetic foot will strike the floor too rapidly after heel contact, causing a slapping noise. Too much resistance (caused by a rear ankle bumper that is too hard) will cause the prosthetic foot to delay striking the floor after heel contact. This will allow the natural rotation of the leg to externally rotate the prosthetic foot before it is flat on the floor. The delay of the sole of the foot in contacting the floor is readily observable as the amputee walks.

8. *Is the "piston action" between the stump and socket minimal during walking?*

An easy method for determining piston action between the stump and the socket is by observation of the action of the base of the patella as it moves away from and toward the anterior socket rim. A pencil mark on the stump sock can be most helpful in this observation. The motion noticed when the knee

(Cont'd on P. 99)

PROGRESSIVE RESISTIVE EXERCISE AND ITS UTILIZATION IN THE RECOVERY PERIOD FOLLOWING KNEE INJURY.

KARL K. KLEIN*

The use of Progressive Resistive Exercise as a post injury technique has been adequately established as a scientific method of approach in the problem of establishing maximum muscular function.[1] Experimental evidence indicates that the problem of rebuilding to the normal level, that is, the strength before injury, does not particularly need specific technique of application but once this normal level is reached, systematic Progressive Resistive Exercise is needed to build toward maximum muscular strength.[2] Muscular strength is the best natural protection for the knee joint. It is further accepted by the author that due to the known characteristics of muscle atrophy of the quadriceps[3] as well as hamstring muscle groups that the application of Progressive Resistive Exercise from the early restoration phase to completion of the program will produce systematic and insured results of strength recovery reaching well into the maximum areas[4]. Such results may be anticipated within a period of four to eight weeks of exercise on a basis of three exercise periods per week (this time element does not include the immediate post-operative period of approximately two weeks during which light progressive weight work has proved beneficial). In making the preceeding statement the author is not purposely disregarding the recently published work by Muller and Hettinger[5], which indicates the use of a six second static muscular contraction for the building of specific muscular strength, but wishes to recognize the future potential of this significant work as a contribution to the entire area of physical restoration and conditioning.

At present there are two recognized systems of Progressive Resistive Exercise, the DeLorme and Oxford techniques[6,7] which with modifications, have been used in the post-operative and/or post-injury phase of recovery following knee injury. The most recent research relating to specific methodology of progressive techniques was recently published[8] and offers some new concepts, derived from the application of old accepted weight lifting methods, that may be utilized to advantage in this type of exercise program. Such methods are capable of producing exceptionally fine results when scientifically applied and systematically progressed throughout the planned exercise program. The author wishes to stress the need for the utilization of such scientific techniques if the maximum results are to be obtained for the injured athlete. We still have to face the fact that knee injury has been the number one problem of athletic injury for years and along with it is the problem of muscular restoration in collaboration with medical treatment.

Although the major emphasis in muscular restoration has emphasized the quadriceps program the author feels that *the hamstrings should be considered with equal emphasis.* Again reference is made to the broad scope of data gathered by the author, through tensiometer testing of injury cases, which has shown relative hamstring weakness accompanying quadriceps deterioration following injury.

With such information available it is important to stress the need for a parellel emphasis on hamstring development throughout the exercise program. The method of exercise application is determined by the same method as used for the quadriceps exercise and through such consideration maximum functional support is developed. It is of related interest to note the findings of Mathews, Shay and Clarke[9] in their extensive army pack carrying experiments recently published, that there is a high relationship between physical condition and the ability of the musculature to

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[1]DeLorme, T. L. and Watkins, A. L., *Prrogressive Resistive Exercise,* New York: Appleton, Century-Crofts, 1950.
[2]Muller, E. A. and Hettinger, T. H., Uker Unterschiede der Trainingsgeschwindigkeit Atrophierter und Normaler Muskeln, *Arbeitsphysiologie:* 15, 223-230, Dec. 1953 (About the Differences of Training Speed in Atrophied and Normal Muscles—*Max Planck Institute for Labour Physiology,* Dortmund, Germany.
[3]Smillie, I. S. *Injuries of the Knee Joint,* Edinburgh; E. & S. Livingstone, Ltd. p. 1-13, 1951.
[4]Klein, K. K., A Study of Cross Transfer of Muscular Strength and Endurance Resulting from Progressive Resistive Exercise Following Injury, *Journal of the Association for Physical and Mental Rehabilitation,* 9:5: 159-161, Sept., 1955.
[5]Hettinger, T. H. and Muller, E. A., Muskelleistung and Muskeltraining, *Arbeitsphysologie,* 15: 111-116, Oct., 1953. (Muscular Efficiency and Muscular Training—*Max Planck Institute for Labour Physiology,* Dortmund, Germany).
[6]DeLorme, T. L., *op. cit.*
[7]Zinovieff, A. N., Heavy Resistive Exercise—The Oxford Technique, *The British Journal of Physical Medicine,* 14: 129-132, June, 1951.
[8]MacQueen, I. J., Recent Advances in the Technique of Progressive Resistance Exercise, *British Medical Journal,* 1193-1198, Nov. 20, 1954.
[9]Mathews, D. K., Shay, C. T. and Clarke, H. H., Relationship Between Strength Loss in Pack Carrying and Certain Motor Physical Fitness Criteria, *Research Quarterly,* 26:4: 426-439.

maintain its strength. Their studies indicate a high relationship between the ability of the hamstrings to maintain strength in physical activity and physical fitness; and that this muscle grouping and its ability to maintain strength during strenuous physical activity is the best predictor of physical fitness. Such findings tend to indicate to the author the possibility of a positive relationship between hamstring strength loss, or lack of it, and the incidence of knee injury. Such a statement may be hypothetical, but it is based on an engineering analysis of the supporting effectiveness of the muscles supporting the knee in relationship to applied force in contact activity.

The question of determining the exact starting place and method of program progression undoubtedly is of fundamental concern to all interested in handling the problem from the standpoint of its scientific application. The simplicity of utilizing the Single Maximum lift technique as the fundamental factor for the basis of programming has already been established[10]. This technique has been used to advantage without the use of other testing apparatus and has proved to be an effective method for use in establishing the individual exercise program.

The following information has been published and extracted as reference here. Such information will be used as the basis for the program that is to be presented later on in this paper. The use of the tensiometer[11] is a valuable asset in the total procedure in that it assists in reducing administration time as well as aiding the gathering of accurate data. Specific reference is made to the recent research by Clarke[12] in which the study recommended 50% of the tensiometer reading for the 10RM of quadriceps exercise when the measure of strength is made at 135°.

In further discussing the Single Maximum Lift technique the following points have to be considered:[13]

1. Accuracy of measurement is necessary for determining the single maximum lift capacity of the subject. *It is what the patient can do once to complete extension and not repeat a second time.*
2. If the subject is able to complete a second lift, be sure to allow a rest period before again attempting another effort to determine the single maximum lift.
3. The estimation of the single maximum lift capacity is the most difficult part of the total program to establish. Accuracy here will greatly enhance the development of the rest of the program.
4. To determine the 10RM of capacity from the single lift capacity, subtract five pounds from the total weight load and the remaining weight may be used for the first exercise period.
5. If the subject is not able to complete the 10RM on the first day of exercise he will probably do so by the end of that week. If the same situation occurs during the second week a greater reduction is probably necessary from the single lift capacity.
6. If continued deviations from the normal test pattern persist over a two week period, further study of the individual problem is recommended in order that maximum benefits may be insured.
7. The problem of individual differences should be considered in making deviations from the established procedures.

In the total experiments eight subjects participated and a total of thirty-eight tests were administered for determining the 10RM, from the single lift capacity, *by reducing the weight load five pounds.*

Another question likely to arise is the method for progressively incrementing the amount of weight to be added weekly in order to advance the strength development of the subject. Again reference is made to the experimental study by Zinovieff[14] which indicated *that an increase of ten pounds in maximum single lift capacity per week can be expected through the application of the Oxford technique.* This method of weight addition was also used by Klein and Johnson and was found to work satisfactorily in the number of tests previously discussed. During the past four years of identical method of weekly weight addition to the 10RM has been used by the author with exceptionally fine results. During this period approximately one hundred exercise programs have been successfully administered under this technique.

The primary purpose of Progressive Resistive Exercise deals with the problem of strength building. Where muscle atrophy and/or muscular weakness exists and the restoration of strength is the chief objective,[15] i.e. strength for support, then it is imperative that the areas of maximum muscular capacity be utilized in the exercise processes and that weekly increases of weight application be necessary for continuous building of muscular strength. Efforts to increase muscular strength by the use of light weights

[10]K'ein, K. K. and Johnson, E., Research: A Method of Determining the Maximum Load for Ten Repetitions, in Progressive Resistive Exercise for Quadriceps Development, *Journal of the Association for Physical and Mental Rehabilitation*, 7: 4, July, 1953.

[11]Clarke, H. H., *Cable Tension Strength Tests*, Chicopee, Mass.: Brown-Murphy Co., 1953.

[12]Clarke, D. H. and Herman, E. L., Objective Determination of Resistive Load for Ten Repetitions Maximum for Quadriceps Development, *Research Quarterly*, 26: 4, Dec., 1955.

[13]Klein, K. K. and Johnson, E., *op. cit.*

and increased repetition ofs exercise are endurance-producing and will not significantly raise strength levels to expectations. Smillie[15] states that, "endurance is a quality of normal muscle which *should not* be sought until the muscle returns to normal strength levels."

The foregoing material has been presented as evidence that thought and effort has gone into the development of specific exercise techniques to be utilizd in the problem of restoration following knee injury. It has been pointed out previously that atrophy of the supporting musculature of the knee is quite rapid and failure to apply the use of specific exercise techniques in the rehabilitation program only increases the potential of future injury as well as physical inefficiency on the part of the athlete due to the lack of functional support and stability.

The following are to be considered as practical suggestions for the development of the individual exercise program for strengthening the supporting musculature of the knee. It is important to remember that the planning and development of the program is based on individual testing and evaluation:

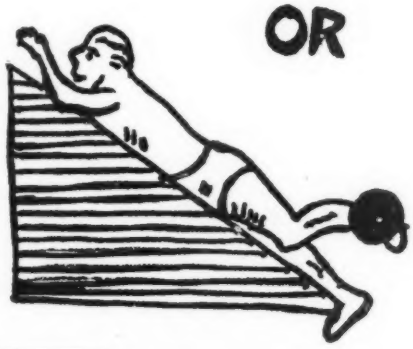
1. Work in close cooperation with the team physician or orthopedist related to the specific problem. Have him determine just when Progressive Exercise program should begin.
2. Be sure that adequate instructions are given to the subject so that the exercise will be carried out exactly as prescribed and make use of an exercise chart that is progressed weekly.
3. Demonstrate and explain correct exercise procedures and insist that they be carried out exactly as prescribed.
4. Start each exercise program with a few repetitions of light weight work. i.e. if the maximum 10RM is 40 pounds, warm up with four or five repetitions of 20 pounds.
5. Emphasize the importance of the rest period between each set of the prescribed exericse.
6. Before testing for maximum single lift have subject warm up with light weights.
7. Stress the *importance of complete leg extension in all quadriceps exercise.*
8. In hamstring exercise stress the importance of not flexing beyond 90 degrees. Beyond this point the hamstrings have a tendency to relax and lateral sway can be dangerous. (refer to diagram).
9. Impress the necessity of regularity in exercise application.

Certain fundamental equipment is necessary for the administration of this type of progressive exercise program:

a) —one iron or aluminum boot and cross bar and snap on clips.
b) —a variety of graded weight from two and one-half to twenty pounds, (about one hundred pounds in all.)[16]
c) —one exercise table or bench and one stall bar or low bench for subject to sit on while changing weights.
d)—one strap to be used as a guide for the raising and lowering of the boot during exercise. This assistance, although not actually an active action, prevents lateral sway of the boot. This assistance is especially important in the hamstring exercise.

The following is an example of a progressive resistive exercise sequence that may be used as a guide for programming other specific problems. The awareness of cross transfer of training[17] to the contralateral side must be considered as the program progresses because the single maximum strength of the unexercised side is the strength goal objective for the exercised leg and is the guide to the development and restoration of bilateral muscular balance.

OR



[14]Zinovieff, A. H., *op. cit.*
[15]Smillie, I. S., *op. cit.* p. 1-18.
[16]DeLorme, T. L. and Watkins, A. L., *op. cit.*
[17]Klein, K. K. and Williams, H. E., Research: A Study of Cross Transfer of Muscular Strength Gains During Reconditioning of Knee Injuries, *Journal of the Association for Physical and Mental Rehabilitation*, 8: 2, March, 1954.
[18]MacQueen, I. J., op. cit.

Progressive Resistive Exercise Program — Quadriceps and Hamstrings*

	1st Week			**2nd Week**	
	10 RM**	25 lbs.		10 RM	35 lbs.
	5-8 RM	35 lbs.		5-8 RM	45 lbs.
Quads	1-4 RM	40-45 lbs.	**Quads**	1-4 RM	50-55 lbs.
	15 RM	15 lbs.		15 RM	25 lbs.
	10 RM	20 lbs.		10 RM	30 lbs.
	5-8 RM	30 lbs.	**Hamstrings**	5-8 RM	40 lbs.
Hamstrings	1-4 RM	35-40 lbs.		1-4 RM	45-50 lbs.
	15 RM	10 lbs.		15 RM	20 lbs.
	Single lift capacity should be about 50 lbs. Test unexercised side.				
	3rd Week			**4th Week**	
	10 RM	45 lbs.		10 RM	55 lbs.
Quads	5-8 RM	55 lbs.		5-8 RM	65 lbs.
	1-4 RM	60-65 lbs.		1-4 RM	70-75 lbs.
	15 RM	35 lbs.	**Quads**	15 RM	45 lbs.
	10 RM	40 lbs.		10 RM	45 lbs.
Hamstrings	5-8 RM	50 lbs.		5-8 RM	55 lbs.
	1-4 RM	55-60 lbs.		1-4 RM	60-65 lbs.
	15 RM	30 lbs.	**Hamstrings*** **	15 RM	35 lbs.
	Single lift capacity should be about 70 lbs. Test unexercised side.			Re-check single lift of both legs at end of 6th week. Approximate balance should be obtained.	
	5th Week			**6th Week**	
	10 RM	65 lbs.		10 RM	75 lbs.
	5-8 RM	75 lbs.		5-8 RM	85 lbs.
Quads	1-4 RM	80-85 lbs.	**Quads**	1-4 RM	90-95 lbs.
	15 RM	55 lbs.		15 RM	65 lbs.
	10 RM	50 lbs.		10 RM	55 lbs.
	5-8 RM	60 lbs.		5-8 RM	65 lbs.
Hamstrings	1-4 RM	65-70 lbs.	**Hamstrings**	1-4 RM	70-75 lbs.
	15 RM	40 lbs.		15 RM	45 lbs.

* The first three exercises in each category are strength-building; the fourth is for development of endurance.
** RM—Repetition maximum for the particular bout of the exercise; lower leg to full extension and return to flexion in quadriceps exercise and flexion to 90 degrees and return to extension in hamstring exercise. Exercises are performed with an even sustained contraction of about 2 seconds to full extension and 2 seconds to flexion.
*** Experience indicates that at some place during the exercise program, the hamstrings lose their ability to advance at the same rate as the quadriceps.

The foundation of the described programs are drawn from the work of Zinovieff, DeLorme and MacQueen combined with the author's experience in this area of rehabilitation. The program is developed for three exercise periods per week with one day of rest between each period. The maximum application should be no more than four periods per week. Excessive exercise is detrimental to progress[18]. The program is outlined in Table I.

There is evidence, as a result of extension research data, which indicates that the average hamstring muscle strength is only about 62% of the average quadriceps strength of a large number of athletes that have been measured. This strength relationship may readily account for the necessity of reducing hamstring weight load in the latter part of the program because this muscle group reaches its maximum potential more rapidly in the specific type of exercise used and its capacity to continue the heavier weight load is decreased.

Further emphasis may be given to the rebuilding of the qualities of muscular endurance by additional activities that are of endurance status: i.e. running on a smooth surface, use of a tread mill, etc. Care should be taken in giving specific instructions not to participate in running activities that require fast changing of direction during the early phase of the recovery program.

Double Boot* Program

	7th Week			**8th Week**	
Quads	10 RM	120 lbs.	**Quads**	10 RM	140 lbs.
	5-8 RM	140 lbs.		5-8 RM	160 lbs.
	1-4 RM	150-160 lbs.		1-4 RM	170-180 lbs.
	15 RM	100 lbs.		15 RM	120 lbs.
Hamstrings	10 RM	80 lbs.	**Hamstrings**	10 RM	100 lbs.
	5-8 RM	100 lbs.		5-8 RM	120 lbs.
	1-4 RM	110-120 lbs.		1-4 RM	130-140 lbs.
	15 RM	60 lbs.		15 RM	80 lbs.

* Double Boot—long bar with both boots on the bar. The weights are placed on side of the boots and locked on. Both legs are exercised simultaneously.

If bilateral balance is obtained it is always possible to continue the program for a few more weeks to raise the total strength level. This can be accomplished by utilizing a "double boot" program i.e. using twice the weight load of the single boot exercise program and starting it from the previously listed program. The weight loads could be doubled but have been reduced with evidence of satisfactory results. If there is evidence of bilateral muscular weakness, with balance existing, then a double boot program may be used from the beginning. The determination of the single lift capacity would be the starting place for development of the program. Outline for a suggested "double boot" program is offered in Table 2.

It is suggested that following each exercise program the hamstrings be stretched by a series of toe touches from a standing position; ten to fifteen stretches should be done. This suggestion is made because of the tendency of the hamstrings to shorten during activity and the muscle elasticity should be maintained for maximum functional development.

The planning of the exercise program is an individual proposition and should be considered as such when making the initial evaluations for determining the exercising sequence. Accuracy is important because it is only through accuracy of measurement that the maximum progress can be expected in a reasonable amount of time. i.e.—four to eight weeks depending on the starting condition.

Contact with the team physician is important so that he will know of the progress of the subject during all phases of the program advancement.

If the subject is not able to complete all of the prescribed exercise, in each period, and this situation exists for a week or two then it is essential that a re-evaluation for the Single Maximum lift capacity be accomplished. In this manner maximum progress can be maintained.

Although no guarantee can be made regarding the results of such an exercise program in terms of future athletic competence, one may be assured that the best effort has been given to the process of recovery of maximum function and that a tried and proved system of progressive resistive exercise is the best method of approach to the problem.

HEART SHRINKAGE—Cont'd from p. 88

outs of the endurance type, 5 days per week, we have observed some similar reductions in heart size but not always. The subjects described all lost adipose tissue.

In 1950 we trained a 22-year old non-varsity male (Paul Nakamura) in swimming, progressing to very strenuous work in six weeks. The improvement in an all-out treadmill run was from 1.19 to 1.30 mins 15 miles/hr., 8.6% grade; an improvement of 24 seconds in the 400 yard swim from 6:16 to 5:52. Heart size reduced from 117.1 to 114.4 sq. cms. in diastolic area of the frontal x-ray. Gross oxygen intake capacity increased from 2.28 to 2.61 L./Min. in the all-out treadmill run. The T-wave of the largest precordial deflection in the EGG increased from 7.9 to 14.2 mm. The simplified pulse ratio improved from 186/72 to 174/66 pulse beats/min. Slight reductions occurred in blood pressures. Area of the Brachial Pulse Wave increased from 0.37 to 0.67 sq. cms., and the ratio of the P.W. to area of diastolic heart size from 3.16 to 5.59, or 76.9%.

In 1951 we trained another non-varsity male, (Charles Kristufek) 22 years of age, in jogging three miles per day for six weeks in a time of about 27 mins. There was improvement in his ability to run the mile from 5:57.8 to 5:38. His heart size (diastolic frontal x-ray area) reduced from 189.1 to 186.0 sq. cms. The quiet sitting Brachial Pulse Wave increased from 0.43 to 0.67 sq. cms. The ratio of the Brachial Pulse Wave to Area of the Frontal Diastolic Heart X-ray improved from 2.275 to 3.602, a gain of 58.32% in function, paralleled by improvements in running the mile and swimming 440 yards, but with a reduction in heart size. His all-out treadmill running time improved from 4:00 to 5:15, or 31.25% at 7 mi./hr., 8.6% grade. The highest T-wave in the precordial leads improved from 11.2 to 12.0 mm.

In 1952 we trained a 25-year old male in an all-around swimming-calisthenics-running conditioning program for eight weeks. His all-out treadmill run time improved from 155 secs. to 197 secs., 7 mi./hr./8.6% grade, a gain of 27.10%. Lying pulse rate dropped from 57 to 48 beats/min. Blood pressures reduced, both systolic and diastolic. All cardiovascular indices improved. The simplified pulse ratio improved from 2.51 to 2.28, or 9.16%. The area of the Brachial Pulse Wave improved from 0.58 to 0.60 sq. cms., or 3.45%. The area of the frontal diastolic x-ray reduced from 135.44 to 123.98 sq. cms., or 8.46%. The largest precordial T-wave increased from 6.15 to 9.10 mm., or 47.97%, with a corresponding stroke volume increase from 75.52 to 129.38 c.c./beat by Grollman procedure, a gain of 71.32%. The ratio of the Brachial Pulse Wave Area to the Diastolic Area of the Frontal X-ray improved from 4.28 to 4.84, or 13.08%.

(Cont'd on next page)

These cases indicate that the reduction in heart size occurs in young men as well as older men and that it is strongly associated with reductions in peripheral resistance, indicated by the reductions in quiet systolic and diastolic blood pressures along with increases in stroke volume.

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"From Other Journals"

JAMES HAMILTON DOGGART, "The Impact of Boxing upon the Visual Apparatus," *Archives of Ophthalmology*, 54:161-169, August, 1955.

Derangement of the visual apparatus from boxing may be divided into ocular damage, including lesions of the outer and lesions of the inner eye; injuries to the neighboring structures, and lesions of the visual pathway and other parts of the brain. Boxing is particularly dangerous for myopes, because their eyes are more prominent and more vulnerable than those of the average emmetrope. Medical supervisionu cannot alter the anatomy of the human skull or lessen the delicacy of those organs which subserve our highest faculties. Boxing also has a baneful effect upon the spectators, many of whom consciously or subconsciously utilize boxing to foster their sadistic impulses.

PJR

CHECKOUT—Cont'd from page 93

is flexed should be ignored. It is after the knee is extended and weight placed on the prosthesis that the amount of pumping can be most accurately determined. Displacement of one-half to three-quarter inch is not unusual. Obviously, it is desirable to have little piston action.

9. *Does the prosthesis function in a smooth, noise-free manner?*

   Common areas and sources of noise are:

   a) the ankle joint, which may require greasing
   b) the space between the foot and ankle which may be inadequate and cause rubbing (a home remedy is to insert soap scrapings into the space)
   c) the knee joints, which may require greasing
   d) clicking of the knee joint extension stops, which is usually eliminated by the use of a check lacer or by filing the stops.

At the conclusion of the walking phase of the checkout procedure, the amputee's stump should be examined for any irritated or discolored areas, with particular attention directed to the common areas of discomfort previously described. Some indication of how weight is distributed over the stump can be obtained by the impression left by the stump sock on the skin.

This paper has attempted to delineate the areas considered by the authors to be of major importance in determining the prosthetic adequacy of a below-knee artificial limb.

A. McDOUGALL, "Footballer's Ankle," *The Lancet*, 6902: 1219-1220, December 10, 1955.

Athlete's or footballer's ankle is characterized by bony out-growths along the tibial margins, beneath the malleoli and on the dorsum of the neck of the astragalus, as a result of repeated minor strains of the capsular attachments of the ankle-joint and repeated compression injuries of the bones against each other when the ankle is forcibly dorsiflexed and plantarflexed. The athlete is usually symptom free for a number of years, but then gets pain at the attachment of the joint capsule along the tibial margin and neck of the astragalus. These changes are believed to be a traumatic arthritis. They are especially common among soccer players, but are also found in gymnasts and other athletes. Conservative treatment, consisting of immobilization, followed by physiotherapy and ankle exercises, should be tried first. If this fails an operation must be considered if the player is to continue with his sport. The symptoms will disappear if he gives it up.

PJR

H. V. BLAIR and WILLIAM HEROLD, "Efficiency of Chlorpromazine in Hyperactive Mentally Retarded Children," *Archives of Neurology and Psychiatry*, 74:4:363-364, October, 1955.

In Parsons State Training School, Parsons, Kansas, the Columbia Mental Maturity Scale Test was administered to both the experimental group of ten hyperactive, boisterous students, ages 7-20, and a control group of nearly identical grouping.

In both the experimental and control group the mean IQ was 53.5. After administering 25 mg chlorpromazine t.i.d. for 60 days to each student of the experimental group the

mean IQ jumped to 64.1. The IQ of the control group raised to 56.0.

The authors state that apparently due to removal of severe emotional and nervous disorders the students can function at their true level of mental ability.

JT

J. O. CROMWELL, "Dynamic Concepts Underlying the Use and Prescription if Activities Therapy," *Mental Hospitals*, Vol. 5:9-11, January 1956.

Important in the treatment of mental hospital patients are such dynamics as the provision for needed supplies in a situation where the frustrations are not so great and improvement and recovery take place. Supplies include (1) material supplies—food, clothing, tools, etc. (2) emotional supplies—security, friendship, warm interpersonal relations, social congress, and recognition. (3) spiritual supplies—religious services and informative talks.

In prescribing treatment activities, therapy is stressed. Activities therapy tends to overcome self-centeredness. It provides opportunity, experience, and practice in developing socio-centric attitudes and adjustment techniques. Group activities can foil excessive aggression and hostility, accept it, and give some respect and affection instead of just counter hostility. Through activities the patient tends to learn to respond toward others in a way that gains respect, admiration, approval and support. This gratifies the patient's ego needs for recognition. The inhibited, fearful, repressed patient is emboldened by the action of the patients with opposite leanings; the overly aggressive, uninhibited destructive patient feels the pressure of the group's disapproval and tends to check his impulsiveness. The result is social interaction.

JT

Editorials

EDUCATOR OR THERAPIST?

We normally associate the term "educator" with the school; the term "therapist" with a hospital or clinical situation. However, the corrective therapist is often hard put to dissociate his vocation from either his background or his work with patients. If he is instructing an amputee in the intracacies of climbing stairs; teaching an exercise routine to a paraplegic; or leading a group of psychiatric patients in a modified game, it would be difficult indeed to argue that this therapist is not engaged in a form of education. Since these situations are a common denominator among the duties of the corrective therapist, it follows that the therapist, despite the lack of formality in his approach, is, in part, a teacher in a specialized field.

On the other hand, the idea that a school should provide therapeutic treatment of students with any type of pathological condition is anathema to most educators. However, we find that modern textbooks dealing with the subject of adapted physical education do assign a place in the program for the teaching of various neuromuscular skills which are aimed directly at aiding the handicapped student to perform functional activities. In point of fact, the objectives of the adaped physical education program as interpreted by Daniels are nearly synonymous with the objectives of corrective therapy as they are commonly understood.

Whatever their milieu, it would appear that these two programs have a unique place in the functional development as well as the personality adjustment of the handicapped whether the disabled be a child of 12 or an adult of 35.

During late years the appropriateness of the term "corrective therapy" has been discussed widely. The term undoubtedly originated from "corrective physical education" which was, for many years, the designation of special physical education of a remedial or corrective nature. At the present time, "adapted physical education" seems to have supplanted the older term in general usage since it connotes the wider philosophical scope of this specialty. However, corrective therapists are understandably perplexed by the fact that their designation is tied to a term which has been tried and found to be lacking. They have, therefore, undertaken to investigate the merits of a change in terminology.

The arguments against the adjective "corrective" are too numerous to bear discussion here and there are few who would uphold it from a logical standpoint. Persons who favor retention of the designation do so primarily on the basis that it is a term which has won acceptance among persons familiar with the rehabilitation field and that it would be confusing to change it. This argument is further proof of the need for careful deliberation by the members of this association. Should it be decided that a change is warranted, it is mandatory that the new designation be specific and of the utmost clarity. To do otherwise would be disastrous.

THE GENERAL ASSEMBLY ELECTION

The general assembly of the association is a convocation of all active members who meet once during convention week to elect the organization's new officers. This year's meeting will be held on Tuesday, June 26, at the Bon Air Hotel in Augusta, Ga. If you are planning to attend the convention, please make it a point to be present during this election. It is your only oportunity to record your personal preferences.

PAY YOUR DUES

A new administrative setup has made it possible to set one date as a deadline for the payment of association dues and certification fees. For all active members of the association this date is July 1. Since membership dues are the primary source of revenue for the organization it is imperative that dues be forwarded to the Membership Chairman as soon as possible. No individual can gain by procrastinating on this obligation and your association cannot function without this support.

Book Reviews

Mobilization and Health Manpower. (Washington, D. C.: U. S. Government Printing Office, January 1956. 87 pp.)

This is a study of the supply and demand for "paramedical personnel" to aid the 28,000,000 handicapped or chronically ill Americans. The study was made under the aegis of the Health Resources Advisory Committee, Office of Defense Mobilization, Executive Office of the President. The first few chapters deal with Physical Therapy, Occupational Therapy and Social Work. These can be reviewed competently only by individuals in the fields concerned and will not be considered here. Corrective therapists, however, will have little favorable to say about the section of the report which deals with their specialty. A chapter headed "Related Fields" deals with a miscellaneous group made up of physical educators, recreational therapy, corrective therapy, military reconditioning services, and education. The writers seem unaware of the fact that adapted physical education and corrective therapy are but the two faces of a single coin. Corrective therapists and adapted physical educators are men who have a degree in physical education, plus additional specialized training in rehabilitation and differ only in the area in which they have chosen to apply their training. In the vicinity of Los Angeles at least, nearly every corrective therapist who has left hospital work has done so to enter the teaching field, and there has also been a trickle from the teaching field into hospital work. To divide this group on a "where employed" basis has no logical justification within the structure of this report and results in the self-contradictory assertion that many more adapted physical educators are needed but that there is no demand for increased numbers of corrective therapists. As every chief of corrective therapy knows, it is almost impossible to find qualified personnel, since the demand far exceeds the supply of trained men. The statement that four colleges are providing corrective therapy training programs does not accord with the fact that nine accredited schools are listed in the March-April Scholarship Announcement in this **Journal**. It is even more surprising to find that the Association for Physical and Mental Rehabilitation is not listed under the heading of "National Voluntary and Professional Organizations." This apparently deliberate omission is difficult to understand. Ignorance of its existence cannot be claimed, since it is mentioned in the discussion of corrective therapy. Whatever the merits or demerits of the balance of the report, corrective therapists will not feel that it affords a satisfactory presentation of their specialty.

PJR

"Symposium on Dysmenorrhea," (Available from Mrs. W.D. Miller, Executive Secretary, Phi Delta Pi, R.D. 1, Box 191, Huntington Valley, Pa. 1950. 61 pp. $1.00.)

This symposium is well written and well compiled. It is factual and gives excellent general information. It may clarify the problem of dysmenorrhea among those who work with adolescent girls and women. There may be a tendency to overstress the value of exercise and consequently to give the impression to the layman that the problem is a relatively simple one. However, if one reads the symposium with an open mind, the final impression will be that exercise alone is not the answer. Emotional factors, infections and hormonal imbalance must also be considered. Adolescent girls and women should benefit from the increased knowledge derived by the professional reader of this symposium.

ELS

The Diagnosis and Treatment of Postural Defects," by Winthrop M. Phelps, R.J.H. Kiphuth and Charles W. Goff. (Springfield: Charles C. Thomas. Second Edition, 1956. 190 pp. $6.50)

This is one of the most logically developed books in the entire field of physical education. The first chapter traces the evolution of man's posture; the second describes how posture develops in the years between births and adulthood; the third discusses normal adult posture and the fourth takes up abnormal posture. Succeeding chapters deal with body mechanics, postural examination, posture in physical education and corrective exercises. As will be seen from this outline, just about every phase of the subject of possible interest to physical educators is covered. Occasionally, statements are made in the text which will be a matter of some concern to the reader. He is told, for instance, that only the muscular type can assume the posture formerly considered ideal, and that others should not be expected to do so. Then follows a description of "best posture," leaving the reader to wonder whether this, too, can be assumed only by a given type. Perhaps the wisest words yet written on posture are those of Metheny, in her **Body Dynamics:** "There is no single best posture for all individuals. Each person must take the body he has and make the best of it. For each person the best posture is that in which the body segments are balanced in the position of least strain and maximum support. This is an individual matter." The authors mention that "best posture" can be achieved by training and that "beneficial correlates" of posture training "need no elaboration." The problem is not that simple. Physical educators are primarily interested in function. A small amount of personal experience suggests that the physical educator who attempts to make the round shouldered basketball player or boxer stand erect incurs a grave risk of hindering his performance. Physical educators who saw the fine Danish gymnastic team which toured this country a few years ago have been quite curious about the effect on performance that would result from attempts to correct the noticably lordotic condition of these fine athletes. One wonders whether Kenny Washington would have been equally great if he had assumed the "best posture" instead of the thoroughly relaxed posture for which he is still so well remembered on the Pacific Coast. The authors remark that there is no doubt of the validity of the Krause (sic) and Hirschland claims. This opinion will hardly be shared by readers of the **Journal of Health, Physical Education and Recreation.** Probably most physical educators would agree with the discussion presented by Lawther in the March issue on that publication. From the standpoint of therapists, a discussion of the kinesiological aspects involved in some of these conditions, scoliosis for example, would have proved helpful; these will find it necessary to refer to Steindler or some other text for this background information. A good bibliography is provided, although there are some surprising omissions, such as the Metheny and Steindler texts. The references are grouped alphabetically in a single section. This always makes it difficult to find a half-remembered citation; references grouped at the end of the chapters are much more accessible. The book is lavishly illustrated and well indexed. For physical educators conducting "posture training" classes in schools it is probably the best single text available.

"The Book of Badminton," by Eddy Choong and Fred Brundle. (New York: Philosophical Library. 1956. 128 pp. $3.75.)

This is a pleasant mixture of conversation and instruction. Since it is written for an English audience, some of the material, such as the discussion of the All-England Championships and the pictures of the English teams, will interest only the most rabid American badminton fans. The instructional material is especially valuable for its discussion of tactics. Some of the theories advanced are quite different from the ones commonly advocated in this country and are quite thought-provoking. For the most part this portion of the book is not designed for the beginner; he will be better advised to commence his studies with Jackson and Swan or some other standard text. The style is informal and makes pleasant reading. On the whole the book may be cheerfully recommended for reading by the advanced player.

PJR

Artificial Limbs, September, 1955. (Washington 25, D. C.: Advisory Committee on Artificial Limbs)

Artificial Limbs is actually a magazine; however, since the reviewer has been advised that it will appear only twice a year hereafter, it will probably be more meaningful to treat it as a book. The present issue is devoted almost entirely to the problem of "harnessing" the upper extremity prosthesis, that is, establishing a coupling between the wearer and the mechanism. It is the thesis of the introductory article that satisfaction with an upper-extremity prosthesis depends primarily on the degree to which sensory-motor association is attained. A thorough discussion of the Biomechanics of Control in Upper-Extremity Prosthesis," by Craig L. Taylor, is followed by an article on "Harness Patterns for Upper-Extremity Prostheses," by Robert J. Pursley. A few pages of case histories and minor notes complete the issue. This material is essential reading for everyone who is seriously concerned with the problems discussed. In the opinion of this reviewer, any physician or therapist dealing with amputees who does not take care to see each issue of this magazine as it becomes available is failing in his duty to his patients. It might also be mentioned that articles such as those by Taylor provide a wealth of material for anyone interested in the kinesiology of normal movements and desiring more detailed data than is available in the average undergraduate text.

PJR

"The Athletic Trainer's Handbook," by "Rollie" Bevan. (Englewood Cliffs: Prentice-Hall, Inc., 1956. 116 pp. $3.95)

This little book is an excellent **vade mecum** for the experienced trainer. It is not suitable for the bginner because of the omission of necessary basic information and because of its use of terms and techniques which are neither defined nor described. On page 58 "Charley horse" is correctly described as a bruise; on page 63 it is referred to as a tear. The word "pasture" appears twice; the context suggests that "pastern" is meant. The reviewer has made inquiry of physicians about the use of the techniques of reducing sohulder separations described in the text. They have informed him that this maneuver may not be used by trainers without the incurring of serious legal liability. While this may not be true in other states, certainly its description should be accompanied by a warning. It is somewhat surprising to find the use of the "duck walk" recommended; this has been on the banned list of most trainers for the last several years, due largely to the opposition of Kranz. The advice to the trainer not to let a coach pressure him into playing a boy who is not fit cannot be too strongly emphasized; this is all too seldom stressed in books on training. The book is lavishly illustrated with photographs of taping, manipulative techniques, etc. Most of the pictures are quite good and make a real contribution to the text. A handy index is included. This book is recommended to the trainer who has had some experience and who desires a useful handbook.

PJR

"Champions by Setback," by David K. Boynick. (New York: Thomas Y. Crowell Company, 1954. 205 pp. $2.75)

As the title indicates, this is the story of handicapped individuals who became champions in various sports—baseball, tennis, football, swimming, etc. Eight individuals are covered, although it is not at all clear why Jim Braddock, the boxer, was included in their number. One wonders at the statement that Marion was paid a $250 bonus and a salary of $100 a month to play baseball for the Chttanoga Lookouts, and when dropped played on an amateur team in Atlanta. Shades of Wes Santee! These stories vividly illustrate the thesis that physical handicaps of almost any nature can be overcome by those who are willing to make the intense effort required. They are of an inspirational nature, told simply and clearly. The book should be placed in the hands of every handicapped child; it is a "must" item for the libraries of children's hospitals.

PJR

Chapter Activities

Ohio-Kentucky Chapter

The Ohio Kentucky Chapter of the Association for Physical and Mental Rehabilitation, in conjunction with the Ohio Valley Chapter of the American Association of Rehabilitation Therapists, held its annual Spring Conference at Louisville Marine Hospital in Louisville, Kentucky. The group was welcomed to the Louisville Marine Hospital by Mr. George Baldwin, Manager. The morning session was devoted to a panel on "Medical and Rehabilitation Problems of the Chronically Ill and Geriatric;" Dr. Rex O. McMorris, Medical Director, Rehabilitation Center, Louisville, Kentucky, spoke on the "Medical Problems" involved; Dr. Gradie Rowntree, Industrial Physician, Fawcett-Dearing Printing Co., discussed "Rehabilitation Problems." Mr. Richard Broom, Counseling Unit, State Division of Employment Service of Kentucky spoke on the "Vocational Placement Problems" involved; and, Dr. Alphonse Giuglia, Chief, NP Service, Louisville VA Hospital discussed "Mental Problems of the Chronically Ill, Geriatrics and Tuberculosis Patients." Dr. I. Muss, Chief, PM&RS, Louisville VA Hospital, acted as panel moderator.

The afternoon session consisted of a panel on "Medical and Rehabilitation Problems in Tuberculosis." Participants were Dr. O. N. Shelton, Manager, VA Hospital, Outwood, Kentucky; Dr. Joseph Cox, Chief PM&R, VA Hospital, Outwood, Kentucky; and Mr. James S. Riddle, Counseling Psychologist, VARO, Louisville, Kentucky. Mr. Earl McPheeters, President, AART presided as panel moderator.

Separate business meetings of the participating chapters were held following the conference sessions. Mr. Frank Deyoe, President of the Association for Physical and Mental Rehabilitation gave a brief report on the progress of the Association during the past six months.

The next meeting of the Chapter will be held in the early fall at Dayton, Ohio. Mr. Robert Kohler and Dr. Leo Rosenberg are making the arrangements.

Texas-Louisiana Chapter

The Texas-Louisiana Chapter, APMR, and the Texas Chapter, American Association of Rehabilitation Therapists, held a combined conference at the Veterans Administration Hospital, Houston, Texas on Apr. 7. Dr. Ernest Wilbur, president of the former organization, acted as chairman of the morning session and J. A. B. McLean, president of the AART chapter, acted as chairman of the afternoon session.

Following a welcoming address by Dr. Lee D. Cady, manager of the hospital, Dr. Isham Kimbell presented a paper on the "Effects of Tranquilizing Drugs On Neuropsychiatric Patients" and Dr. Stanley Olson, Dean of the Baylor Univ. College of Medicine, spoke on "Training Needs of Ancillary Personnel for Rehabilitation." A panel discussion on Industrial Therapy, with Dr. Lewis A. Leavitt acting as moderator, completed the morning session.

The afternoon program included talks by Dick Bartin, Sales supervisor of Braniff Airlines and Frank A. Liddell, Jr., a law student, on "What Rehabilitation Means to Me"; a paper on cineplasty presented by Dr. Wilbur; and a final talk by Dr. Ross Weisinger, Attending Staff Physiatrist at VAH, Houston on "Effects of Immobilization."

Eastern States Chapter

New chapter officers include: John J. Baldino, Bronx, N. Y., President; Luther Thomas, Mt. Vernon, N. Y., Vice-President; Donald Kardok, Bayside, N. Y., Vice-President; Juilius Levin, New York City, Secretary-Treasurer; Norman Ness, Northport, N. Y., Recording Secretary; Leo Berner, Bayside, N. Y., Director, Publications; Sam Boruchov, Kew Garden Hills, N. Y., Past President.

The Eastern States Chapter held a spring session on rehabilitation at the Veterans Administration Hospital in New York on May 5. Sam Boruchov and Arthur Taber acted as chairmen of the meeting which included talks by William

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J. Dann, manager of the hospital; Dr. A. B. C. Knudson, Director, PMRS, Veterans Administration; Dr. Bernard Stoll, Chief, PMRS, at the host hospital; Paul Strachan, president, American Federation of the Physically Handicapped; and Joseph Van Schoick, executive assistant, PMRS, Veterans Administration.

DR. ABRAMSON NAMED "HANDICAPPED MAN OF THE YEAR"

Dr. Arthur S. Abramson has been unanimously selected as "Handicapped Man of the Year" and will receive the annual trophy awarded by thePresident's Committee on the Employment of the Physical Handicapped.

Dr. Abramson, former Chief, Physical Medicine and Rehabilitation Service at the Bronx VA Hospital, is at present Professor and Chairman of the Department of Rehabilitation Medicine, Albert Einstein College of Medicine, Yeshiva University, New York. He is a prominent author and lecturer in his medical specialty.

Dr. Abramson, a paraplegic, suffered his disability as a result of gun shot wonds incurred during tne Battle of the Bulge during World War II.

In citing Dr. Abramson, the President's Committee paid tribute to "the great inspiration example of rehabilitation that he represents, for the outstanding contribution that he is making to restoration of seriously handicapped persons to usefulness in the field of medicine and rehabilitation and for the leadership he has provided toward returning the disabled to independent living."

URGES PHYSICAL FITNESS PLAN

Dr. Joseph B. Wolffe, president of the American College of Sports Medicine, proposed that "a bill of rights for national fitness" be provided which would close "the wide gap which exists between our progress in medicine and the facts of fitness in our country" The proposal was made at the closing meeting of the American College of Sports Medicine's third annual convention in Chicago.

Under the proposal, Government resources would support the plan together with "a pooling of America's creative brain-power in medicine, education and related sciences."

MOREHOUSE HEADS RESEARCH GROUP

Dr. Lawrence Morehouse, physiologist at the University of California at Los Angeles, is heading a group of scientists in studying the hearts of athletes now engaged in Olympic trials. The group recently completed a series of electrocardiograms on seventy-five contestants for the Olympic wrestling team and will continue their studies on weight-lifters and distance runners. Dr. Carlyle Stout, cardiologist at the College of Medical Evangelists; David Geddes and Philip J. Rasch, doctoral candidates in physiology at the University of Southern California; and Gene O'Connell, a graduate student at U.C.L.A. are assisting in the project.

ANNUAL VA REPORT AVAILABLE

The story of Veterans Administration service to veterans in Fiscal Year 1955 is related in the Annual Report of the Administrator of Veterans Affairs, now on sale from the Government Printing Office, Washington 25, D.C., at 75 cents per copy. The 1955 Annual Report covers VA expenditures and services during the year ending June 30, 1955. It tells how VA administered the nation's program to rehabilitate its disabled veterans, to assist financially the widows and orphans of deceased veterans, and to aid in the readjustment of ex-servicemen to civilian life.

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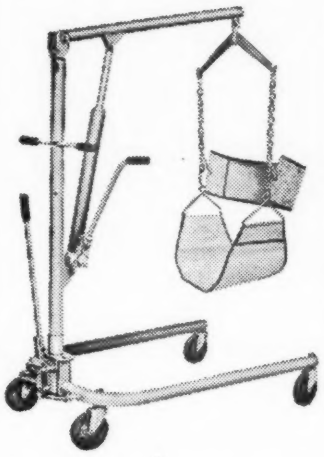

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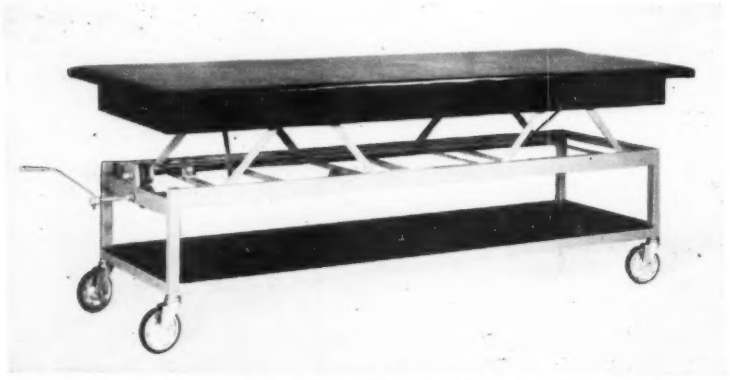

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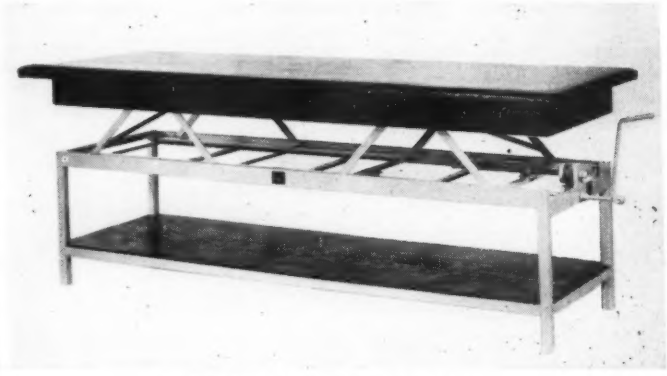

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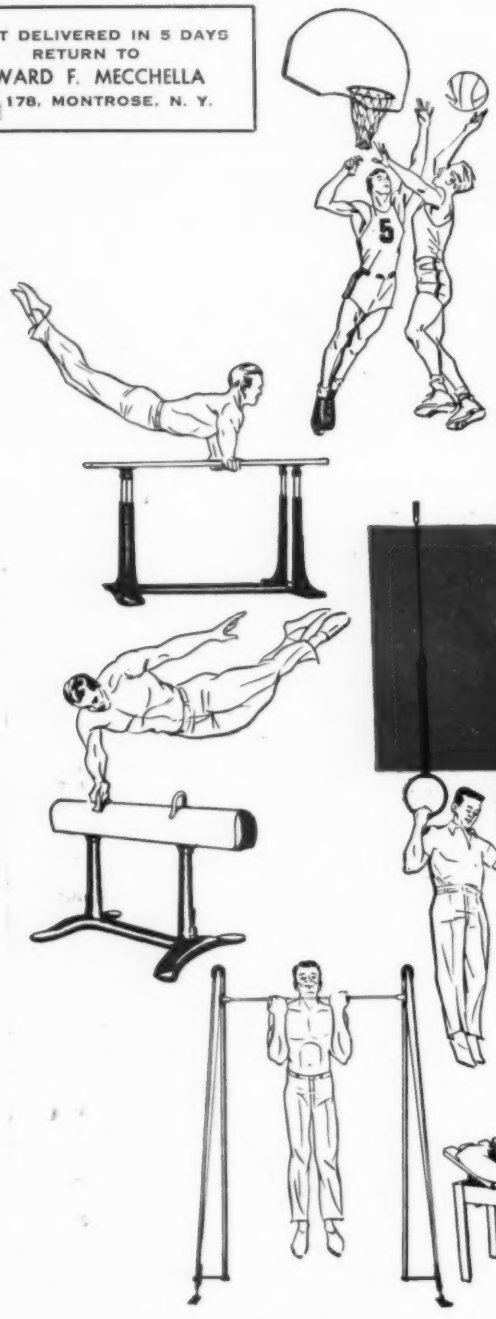

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